

Boundary Object

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Abstract

“Boundary object” (BO) is a concept that has been widely applied to classifications and other forms of representation in knowledge organization (KO) since 1988. Its point of departure is that different groups of actors have different interests and perspectives. To facilitate intergroup cooperation under such conditions, the concept of the BO was proposed as a means of coordinating actions and beliefs. Although a representation (e.g., a map) facilitates some interests and purposes at the expense of others a BO (which may also take the form of a map) does not require a single, universally accepted interpretation. At the same time, it is plastic enough to represent different perspectives and robust enough to serve as a productive shared representation for the groups involved. The literature has, however, identified important problems concerning BOs, including ambiguities in the concept itself and the recognition that BOs cannot be neutral representations, but necessarily embody particular selections and standpoints. These theoretical issues are presented and discussed, and it is concluded that the foundation of any representation must ultimately rest on an analysis of consequences, as later demonstrated in the book *Sorting Things Out*, and on a choice among paradigms or conceptual schemes, as suggested by the domain-analytic approach in information science. If this is neglected, the BO either becomes a trivial concept used retrospectively as a descriptive label or risks imposing undesirable ideological views on the actors involved.

Keywords: boundary object; classification; “trading zone”; epistemological issues

1. Introduction

The concept of the boundary object (BO) was coined by sociologist Susan Leigh Star (1988; reprinted in 1998 and 2015),¹ although another article by Star and Griesemer (1989) is often regarded as the original introduction of the concept. While BO has become a highly used and widely cited concept both in relation to knowledge organization (KO) and in many other fields,² it has also proven difficult to define clearly, for example in the sense that almost anything may come to be described as a BO. In addition, as described by Trompette and Vinck (2009, p. a), during the existence of the concept, its application has partly become autonomous from the original conceptualization. For these reasons, any introduction to the concept must consider the purpose that Star (1988) and Star and Griesemer (1989) intended it to fulfill.

Star’s intention was that BOs should explain how different objects (e.g., a map) may facilitate cooperation be-

tween different groups of scientists—and non-scientists, such as amateurs and administrators—with different interests, forms of knowledge, and perspectives. In order to function as a BO, certain conditions must be fulfilled, and Star used such conditions to classify different kinds of BOs. Star (2015, p. 251) wrote: “Boundary objects are objects that are both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites.” This is, however, a highly abstract definition, and it unfortunately does not clarify under what conditions an object, such as a map, is sufficiently plastic and sufficiently robust to function as a BO.

We are therefore faced with a further problem concerning Star’s implicit assumptions about the sociological problem of cooperation, as well as her implicit ontological assumptions about what an object is, and her epistemological assumptions concerning how BOs are to be identified.



In addition, it is necessary to consider how philosophical views concerning the inevitable theory-laden and political nature of representations relate to the BO concept. Can BOs facilitate cooperation between different perspectives in a neutral way?

These difficulties place certain demands on the aims and contributions of the present article. While the article is intended as an encyclopedic review of the BO concept, with special emphasis on its role in KO, it should now be clear that such a review is not possible without engaging in theoretical discussion and considering the conceptual critiques that have been raised.

This means that the article cannot merely reproduce Star's ideas, but must also provide an interpretation of the philosophical framework within which those ideas were formulated. We cannot, for example, simply assume that a BO is any object (e.g., a library) used by heterogeneous groups of users. A BO must facilitate cooperation between different social worlds characterized by very different "definitions of the situation". It is therefore also necessary to consider the sociological problem of cooperation across divergent languages, worldviews, and "irreconcilable epistemologies" in relation to Kuhn's (1962) influential concept of "incommensurability", according to which scientists working within different paradigms may, in a sense, talk past one another, while cooperation becomes muddled by confusions concerning terms, contexts, and consequences.

It follows that a normative perspective on BOs cannot be avoided, and that this article therefore cannot be purely descriptive. Two issues are particularly important: (1) whether BOs are limited to hindsight-based descriptions of how scientists have previously used shared objects, or whether the concept may also serve as a prescriptive framework for designing objects that facilitate cooperation between "irreconcilable epistemologies"; and (2) whether normative philosophical frameworks can be separated from BOs' sociological and descriptive role in explaining cooperation between heterogeneous communities of practice. In relation to what has already been said—and what will later be developed concerning the political nature of BOs—it is argued that such a separation is impossible. Because any knowledge organization system (KOS), and thus any BO, necessarily privileges some perspectives at the expense of others, cooperation mediated through a KOS or BO is inevitably influenced by the often implicit and "slanted" nature of representations.³

The article is organized as follows. Section 2 introduces the original articles by Star (1988) and Star and Griesemer (1989), as well as subsequent writings concerning the meaning of the BO concept and the mainstream interpretation of BO theory. Section 3 presents the work of the American historian and philosopher of science Peter Galison on the same general problem: how scientists with different backgrounds and perspectives manage to cooperate. Galison introduced the concept of "trading

zones", which he later explicitly compared to Star's BOs. He situated these concepts within a discussion of three epistemological positions—(1) logical positivism, (2) anti-positivism, and (3) anti-reductionism—and thereby contributed to a deeper understanding of BOs. Section 4 presents four important criticisms of the BO concept: (1) the criticism by Huvila et al. (2017), focusing mainly on the lack of conceptual specification; (2) the criticism by Smith (2015) concerning the ontological status of objects—whether they are "given" or "constructed"; (3) the analysis by Huvila (2011, p. 2528) concerning the inevitable non-neutrality of BOs; and (4) Margolis and Blomsma's (2023) criticism that BOs are predominantly described retrospectively rather than developed prescriptively. Section 5, "Applications in information science and KO", mainly considers theoretical aspects of Star's BO research in relation to different theoretical approaches to classification. Finally, Section 6 draws up the theoretical arguments and points out that information specialists necessarily are participants in struggles concerning classifications and other objects used for cooperation between different groups.

2. Origin and Meaning of the Term BO, and the Mainstream Interpretation of BO Theory

Susan Leigh Star was a sociologist whose research centered on science and technology studies (STS). Her research interests included cooperation between different groups of scientists who, as she wrote (Star, 2015, p. 251) "cooperate without having good models of each other's work" and (ibid., p. 248) employ "irreconcilable epistemologies".

2.1 The Original Introduction of BO

The BO concept was introduced in Star (1988) as an important idea in relation to high-level requirements for distributed artificial intelligence systems. The article criticized the Turing test because it presupposed a closed-world model rather than an open-systems model, and because it focused on individuals rather than communities. Star (1988; reprinted in 2015, p. 247) argued that distributed artificial intelligence systems must deal with the simultaneous existence of multiple viewpoints and the need for solutions that remain coherent across such divergent perspectives.

In Star's original introduction of BOs (1988; 2015 reprint, p. 251), she wrote:

"Some findings from our studies of scientists of potential interest to distributed artificial intelligence are that scientists

1. cooperate without having good models of each other's work;

2. successfully work together while employing different units of analysis, methods of aggregating data, and different abstractions of data;
3. cooperate while having different goals, time horizons, and audiences to satisfy.

They do so by creating objects that serve much the same function as a blackboard in a distributed artificial intelligence system.⁴ I call these boundary objects, and they are a major method of solving heterogeneous problems. Boundary objects are objects that are both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites.”

Star (2015, pp. 253–255) introduced four types of BOs created by participants in her studies. She explicitly regarded these categories as non-exhaustive, although she never expanded the typology:⁵

- Repositories are ordered collections of objects indexed in standardized ways, such as libraries or museums.
- Ideal types or Platonic objects are objects such as maps or atlases that do not accurately describe the details of any one locality. They are abstracted from specific domains and may therefore remain vague. Precisely because of this vagueness, however, they can be adapted locally and thereby serve as symbolic means of communication and cooperation.
- Terrains with coincident boundaries are common objects sharing the same external boundaries while differing internally. They arise when work is distributed geographically and when different methods of aggregating data are employed. Such objects permit local autonomy while preserving a common referent.
- Forms and labels (called “standardized forms” in Star and Griesemer, 1989) are BOs devised as means of communication across dispersed work groups. Amateur collectors, for example, were provided with standardized forms to complete when submitting animal specimens.

The empirical material in the original article is, although comprehensive, relatively weak in its illumination of the BO concept, and this makes it difficult to determine precisely what Star meant by BOs. She referred to earlier studies of clinical and basic researchers (Star, 1989), as well as to material later presented in Star and Griesemer (1989). While we are informed about differences in the perspectives and interests of clinical and basic researchers, we are told little about how cooperation actually occurred, how BOs supported such cooperation, or whether some BOs functioned more successfully than others.

Star’s article largely suggests that repositories such as libraries are used by different groups because they are sufficiently plastic to accommodate multiple interests while robust enough to maintain a common identity. However, it provides little analysis of how such repositories were actually used or with what consequences. It is also characteristic of both this study and Star and Griesemer (1989) that the descriptions of BO use rarely expose conflicts of interest between the groups—or “social worlds”, as Star called them—or explain how such conflicts were managed. This raises the question of whether some actors may simply have been compelled to use objects imposed by more powerful participants in the collaboration.

A repository, for example, must organize its collections according to particular principles, and the choice of organizational principles strongly affects how well the repository supports the information needs of different user groups. It is now widely recognized that such standards and procedures cannot be neutral, but necessarily privilege some interests at the expense of others. This aspect is nevertheless largely neglected in Star’s empirical descriptions.

Similarly, Star’s (2015, p. 251) claim that BOs “serve much the same function as a blackboard in a distributed artificial intelligence system”, and that “like the blackboard, a boundary object ‘sits in the middle’ of a group of actors with divergent viewpoints”, is not strongly reflected in the empirical material presented. In the blackboard metaphor, different groups actively contribute to the evolving representation, which thereby becomes a product of interaction among perspectives. However, there is little indication in the original article that BOs were developed through such collaborative processes, and the blackboard metaphor was not pursued further in Star and Griesemer (1989).

2.2 *The Study of Berkeley’s Museum of Vertebrate Zoology (MVZ), 1907–1939*

Star and Griesemer (1989) described the history, purposes, and actors associated with the Museum of Vertebrate Zoology (MVZ) from its foundation in 1907 to 1939. BOs were defined as follows (Star and Griesemer, 1989, p. 393):⁶

“Boundary objects are objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use, and become strongly structured in individual-site use. These objects may be abstract or concrete.⁷ They have different meanings in different social worlds, but their structure is common enough to more than one world to make them recognizable, a means of translation. The creation and

management of boundary objects is key in developing and maintaining coherence across intersecting social worlds.”

In the article, BOs are exemplified by, among other things, species represented in the museum’s collections, described as (p. 410) “a concept which in fact described no specimen, which incorporated both concrete and theoretical data and which served as a means of communicating across both worlds”. Another example is topographical maps of explored regions.

The article characterizes BOs as:⁸

- scientific objects inhabiting several intersecting social worlds while satisfying the informational requirements of each;
- objects sufficiently plastic to adapt to local needs while remaining robust enough to maintain common identity;
- objects weakly structured in common use but strongly structured in local use;
- objects that may be abstract or concrete; and
- objects having different meanings in different social worlds while remaining recognizable across them as means of translation.

Again, however, the central issue concerns how BOs are supposed to facilitate cooperation between groups working with “irreconcilable epistemologies” or lacking “good models of each other’s work”. It is not easy to determine precisely how Star and Griesemer demonstrate this, because their lengthy historical descriptions of MVZ’s purposes, actors, and institutional development are only loosely connected to their theoretical claims concerning BOs. Moreover, the article is primarily a historical account rather than a sociological analysis of how translation processes between actors are actually carried out.

Star and Griesemer (1989, p. 392) wrote:

“There, several groups of actors—amateurs, professionals, animals, bureaucrats and ‘mercenaries’—succeeded in crafting a coherent problem-solving enterprise, surviving multiple translations.”⁹

The claim is thus that “translations” between social worlds enabled cooperation and that BOs facilitated such translations. A retrospective clarification was later provided by Griesemer (2015, p. 206):

“Hunter H uses a dead animal A as a specimen S for collector C for the purpose of economic exchange E. Collector C uses dead animal A as a specimen S for hunter H for the purpose of scientific research R.”

In simpler terms, hunters were paid by MVZ to collect animals, which museum researchers incorporated into scientific collections. Hunters and researchers belonged to different social worlds, yet cooperation was possible because the collected animals/specimens functioned as shared reference points.

Star and Griesemer do not, however, empirically demonstrate that BOs mediate between independent perspectives through observable processes of translation. Rather, they provide illustrative cases suggesting retrospectively that shared artifacts enable coordination among heterogeneous participants. The analysis does not systematically compare how the same objects are interpreted across groups, nor does it document in detail how meanings are negotiated.¹⁰

To explain “translation”, Star and Griesemer (1989, p. 387) wrote that “two major activities are central for translating between viewpoints: standardization of methods, and the development of ‘boundary objects’.” This reveals an unresolved tension in their framework. While BOs are initially presented as alternatives to standardization, standardized artifacts later in the article become incorporated into the typology of BOs themselves. This suggests that coordination may often be achieved not through flexible mediation between perspectives, but through adaptation to standardized categories imposed upon participants.

The article presents a variety of actors: Annie Alexander, founder of MVZ; zoologist Joseph P. Grinnell, the museum’s first director; amateur collectors; trappers; and university administrators. While their interests and visions are described to varying degrees, the article does not systematically analyze how these perspectives were negotiated or how they contributed to the development of specific BOs.

Star and Griesemer nevertheless concluded (1989, pp. 413–414):

“By reaching agreements about methods, different participating worlds establish protocols which go beyond mere trading across unjoined world boundaries. They begin to devise a common coin which makes possible new kinds of joint endeavour. But the protocols are not simply the imposition of one world’s vision on the rest; if they are, they are sure to fail. Rather, boundary objects act as anchors or bridges, however temporary.”

Whereas the earlier “blackboard” metaphor implied mutual participation in shaping representations, the listed types of BOs often appear instead as structures imposed upon participants or accepted because of institutional incentives and dependencies.

We may therefore conclude that Star and Griesemer do not empirically demonstrate that BOs mediate between fully independent perspectives through identifiable transla-

tion processes. Rather than tracing in detail how coordination emerges in the absence of consensus, or how specific artifacts stabilize cooperation, they infer such mechanisms from the mere existence of coordinated activity within heterogeneous institutional settings. The concepts of “boundary object” and “translation” therefore function more as interpretive frameworks than as empirically demonstrated explanations. This issue becomes particularly important because the authors explicitly contrasted BOs with:

“imperialist imposition of representations, coercion, silencing and fragmentation” (p. 413).

BOs are thereby implicitly presented as neutral alternatives to domination and coercion. However, the empirical material does not convincingly establish this neutrality. The possibility therefore remains that coordination depends less on mutual translation than on participants’ adaptation to dominant classificatory frameworks.

2.3 The Mainstream Interpretation of BO Theory

Some twenty years after coining the term BO, Star (2010), in a partly reinterpretive discussion, identified three components of BOs that she claimed were already outlined in “the original 1989 article”:

- (1) interpretive flexibility;
- (2) the structure of informatic and work-process needs and arrangements; and
- (3) the dynamic between ill-structured and more tailored uses of objects.

She wrote (Star, 2010, p. 602):

“In addition, it [interpretive flexibility] has certainly been the aspect of the boundary objects model most noted and used (in social science, medicine, organization theory, history and feminist theory, and in the new information sciences). Because it was in the right place at the right time, boundary objects became almost synonymous with interpretive flexibility.”¹¹

Interpretive flexibility is the most well-known and most clearly articulated aspect of BO theory, whereas the second and third components are more difficult to understand and were not explicitly developed in the original articles. Interpretive flexibility means that different groups understand or use the same object differently. Although this may appear almost trivial, it presupposes a long intellectual tradition arguing that objects are not simply “given”, but that meaning depends on practices, purposes, theories, and historical contexts, and that classifications and descriptions vary with human activities.

In knowledge organization (KO), similar ideas predated BO theory. They were used, for example, to criticize traditional “content-oriented” approaches to indexing,

which regarded subjects as inherent properties residing in documents. By contrast, the “request-oriented view” (see Hjørland, 2017b, pp. 58–59) understands subjects as properties attributed to documents in order to facilitate particular uses. In this sense, subjects themselves may be regarded as interpretively flexible.

Star (2010, p. 602) further described the second and third dimensions of BOs in the following way:

“The two other aspects of boundary objects, much more rarely cited or used, are (1) the material/organizational structure of different types of boundary objects and (2) the question of scale/granularity. Boundary objects are a sort of arrangement that allow[s] different groups to work together without consensus. However, the forms this may take are not arbitrary. They are essentially organic infrastructures that have arisen due to what Jim Griesemer and I called ‘information needs’ in 1989. I would now add ‘information and work requirements,’ as perceived locally and by groups who wish to cooperate.”

Levina (2005, pp. 112–113) similarly argued that “many explicit objects do not become boundary objects in practice, as agents do not see their local usefulness or fail to establish a common identity for them across sites”. Levina and Vaast (2005) further suggested that a common identity for an artifact can emerge only when participants engage in shared practices and develop a collective identity represented through BOs.

Star (2010) thus increasingly emphasized the infrastructural and organizational dimensions of BOs—an emphasis also characteristic of *Sorting things out* (Bowker and Star, 1999)—and presented these dimensions as integral to the original 1988/1989 formulations.¹² Although such themes are indeed present in the earlier papers, they are less explicitly developed there than later reconstructions suggest. The original articles place stronger emphasis on interpretive flexibility, heterogeneous social worlds, and co-operation without consensus than on infrastructural constraints and organizational requirements.

The mainstream reception of BO theory has nevertheless, as Star herself noted, focused primarily on interpretive flexibility. The core idea is that BOs enable different groups to cooperate despite diverging interests, vocabularies, and worldviews. BOs thereby function as translation devices that allow communities to coordinate their activities without requiring them to abandon their own perspectives.

As will be elaborated later in this article, however, such formulations are difficult to operationalize. The original literature does not explain, for example, why one concept of species rather than another, or one map design rather

than another, would better facilitate understanding between groups while still adequately serving each group's needs. The issue cannot simply be reduced to differences in levels of detail or granularity. For example, the suggestion that different communities may share a coarse-grained classification system while specialists require finer-grained distinctions does not adequately capture the intended meaning of BO theory. Unfortunately, Star and Griesemer (1989) did not provide concrete comparative examples demonstrating how one representation might function more successfully than another as a BO.

There is now a vast literature on BOs. However, the concept has rarely been examined systematically from an epistemological perspective. Since such a perspective arguably provides the deepest level of understanding, it forms the central focus of the present article. A major claim advanced here is that BO theory lacks normative principles. While it may describe how coordination occurs, it does not specify the conditions for such cooperation. In addition, it provides limited guidance for knowledge organization concerning how classifications and other forms of knowledge representation ought to be designed and evaluated.

3. “Trading Zones” and Epistemological Issues

Galison (1997) studied groups of scientists working on the same project at the Los Alamos Laboratory during World War II (Project Y). He contributed the important insight that researchers holding different theoretical positions may nevertheless contribute to a shared outcome even when they do not share a common language. More clearly than in Star's examples, Galison demonstrated how specialists with partially irreconcilable epistemologies succeeded in cooperating in the construction of the first atomic bombs. Unlike the MVZ case, where amateur participants largely appear to have used standards designed by professionals, the scientists involved in Project Y contributed from relatively independent perspectives.

Different groups of researchers, even within the same discipline and project, may possess fundamentally different understandings of terms, methods, and objects. Galison (1997) showed that theoretical physicists, experimental physicists, engineers, and instrument developers each played essential roles in the Los Alamos project. Although each group could work relatively independently, they nevertheless managed to cooperate without sharing a fully common language. Gorman (2016, p. 732) summarized Galison's view as follows:

“These different communities certainly began with apparently incommensurable mental models (Galison, 1997). To explain how these communities learned to work together effectively, Galison borrowed the idea of a trading zone from anthropol-

ogy. To trade, groups do not have to understand each other's mental models; they simply have to agree on goods to exchange.”

Gorman further emphasized that trading zones need not be physical spaces but may instead be defined by the systems groups collectively attempt to construct. Because such work is not entirely divisible, participants must gradually develop partial forms of shared understanding. According to Galison, cooperation may begin with a limited jargon, later develop into a pidgin, and eventually crystallize into a creole capable of supporting a new disciplinary community.

Remarkably, different perspectives may coexist for considerable periods while still contributing to overarching goals. Galison therefore introduced the concept of the “trading zone” to describe how distinct scientific subcultures—such as theorists, experimentalists, and engineers—coordinate despite having different languages, methods, and cultures. He also used the metaphor of “plywood” to characterize scientific results as composites formed by binding together heterogeneous experimental, theoretical, and instrumental layers rather than resting upon a single foundational basis.

Star and Griesemer's BOs and Galison's trading zones emerged independently from different empirical studies, yet both address how heterogeneous communities coordinate without full epistemic agreement. They differ, however, in emphasis: BO theory foregrounds shared objects, whereas trading-zone theory foregrounds interactional practices and emergent contact languages.

It is therefore striking that the BO literature has rarely been systematically co-cited with the literature on trading zones, although Galison (2010, p. 46) explicitly referred to Star and Griesemer's BO concept¹³ and noted how collections of flora and fauna may be used differently by professionals in different fields.¹⁴ He further observed that interdisciplinary collaborations often evolve into new disciplines with their own specialized languages, whereas BOs may be understood as temporary stabilizations within such developing trading languages.¹⁵

Both Star and Galison worked within STS and drew upon broader developments in philosophy of science. Galison's (1997) book explicitly situated trading zones within a discussion contrasting logical positivism, anti-positivism, and anti-reductionism. Because this discussion is highly relevant for understanding BO theory, it is considered below.

3.1 Logical Positivism

Rudolf Carnap was one of the leading figures of logical positivism. His major work, *Der logische Aufbau der Welt* (Carnap, 1928), was developed between 1922 and 1925 and later published in English as *The Logical Structure of the World* (Carnap, 1967). Galison (1997, p. 784)

argued, however, that this title is misleading and should instead be rendered *The Logical Construction of the World*. The point, according to Galison, is that Carnap sought to show how knowledge of the world could be constructed from elementary units of sensory experience expressed in “protocol statements” manipulable through logic.

Carnap (1963, p. 57) later wrote:

“We assumed that there was a certain rock bottom of knowledge, the knowledge of the immediately given, which was indubitable. Every other kind of knowledge was supposed to be firmly supported by this basis and therefore likewise decidable with certainty. This was the picture which I had given in the *Logischer Aufbau*.”¹⁶

Galison (1997) therefore characterized positivism as a view reducing knowledge to experience: theories may change, but protocol statements remain stable. Positivism thus presupposes the possibility of a neutral observational language capable of expressing observations independently of theory.

Galison further noted that many early twentieth-century physicists found this picture attractive. Particularly important for the present article is the implication that correct methods would inevitably lead rational investigators toward agreement. Scientific cooperation was therefore understood as grounded in consensus imposed by nature itself. From such a perspective, concepts like trading zones or BOs would appear unnecessary because different groups were ultimately assumed to converge upon the same observational foundation.

3.2 Anti-Positivism

What Galison (1997) called “anti-positivism” refers to the reaction developed by philosophers such as Kuhn (1962), Hanson (1958), and Feyerabend (1975). These thinkers rejected the idea that Carnapian protocol statements could serve as theory-independent foundations for knowledge. This position introduced the notion of the theory-ladenness of observation:

1. observational terms are partially determined by theoretical assumptions; and
2. investigators’ theories influence what they perceive.

Concepts such as “paradigms”, “frameworks”, and “conceptual schemes” therefore became central. Observation and theory were no longer regarded as separable, but as mutually constituted within broader socio-historical contexts.¹⁷ Galison (1997, p. 793) summarized this development:

“The positivist central metaphor was up-ended: now theory had primacy over experiment/observation.”

The theory-ladenness thesis corresponds closely to Star’s emphasis on interpretive flexibility, which became the dominant feature in the reception of BO theory. Both positions emerged from broader anti-positivist developments emphasizing the situated and socially mediated character of knowledge.

3.3 Anti-Reductionism

Galison (1997) argued that both positivism and anti-positivism represent forms of reductionism: positivism reduces knowledge to experience, whereas anti-positivism reduces knowledge to theory. This characterization is, however, somewhat problematic.

Although empiricism tends toward reduction to experience, and classical rationalism toward reduction to reason, it is misleading to characterize all anti-positivist positions as reductions to theory. Kuhn, Hanson, and Feyerabend are better understood as historicists for whom the relation between theory and observation is dialectical rather than reductionistic.¹⁸ Moreover, Galison’s own anti-reductionism remains a form of anti-positivism.

Galison’s critique of Kuhn is also significant. Kuhn’s framework often implies that a single dominant paradigm governs a scientific period, whereas later interpretations increasingly describe science as multiparadigmatic (e.g., Swift et al., 1973).¹⁹ Galison therefore sought to explain how partially autonomous traditions can nevertheless coordinate without being reduced either to pure observation or to unified theoretical systems.

3.4 Epistemological Consequences for BO Theory

What is crucial for the present article is the abandonment of the idea of a neutral observational language. Nature does not uniquely determine theory choice. Consensus may be constrained by nature, but it is never simply imposed by it.

According to Star and Griesemer (1989),²⁰ consensus is neither necessary for cooperation nor for successful work. BO theory is therefore not about achieving consensus or establishing a shared epistemology. On the contrary, it concerns cooperation despite divergent perspectives and languages. Why, then, do epistemological positions matter for BO theory?

As Huvila et al. (2017, p. 1817) observed, “the notion [BO] is based on specific epistemological assumptions and an understanding of social dynamics between communities based on the work of Latour (2005) and Callon (1984)”. While a full discussion of Bruno Latour and Michel Callon lies outside the scope of the present article,²¹ three epistemological issues are especially important.

First, the claim that BOs function as “means of translation” conflicts with Kuhn’s later view (2000a, p. 238) that genuinely incommensurable theories are untranslatable and that understanding alternative paradigms requires language learning rather than translation. Kuhn (1970, p. 268) wrote:

“Languages cut up the world in different ways, and we have no access to a neutral sub-linguistic means of reporting.”

Although Star and Griesemer did not explicitly invoke Kuhn’s concept of incommensurability, BO theory presupposes comparable conditions of heterogeneous and only partially overlapping interpretive frameworks. BOs were therefore intended as practical mechanisms enabling work to proceed despite incommensurability rather than as solutions eliminating it.

Galison addressed this issue more directly. He argued that scientists do not produce neutral observation languages but instead develop localized contact languages enabling coordination. As he wrote (Galison, 1997, p. 833):

“It is the ability to restrict and localize symbolic systems for the purposes of coordinating them at the margins that is important to the linking of the many subcultures of the discipline of physics.”

This passage may be interpreted as suggesting that BOs function not as neutral mediators, but rather as elements within emerging localized sign systems facilitating coordination.

Second, although actors may cooperate despite divergent interpretive frameworks, it remains crucial whether such cooperation involves what Star and Griesemer themselves called “imperialist imposition of representations, coercion, silencing and fragmentation” (1989, p. 413). If hunters are instructed which animals to collect, then cooperation may reflect institutional authority rather than mutual translation. A retrospective identification of shared artifacts as BOs cannot by itself determine whether coordination emerged through negotiation or through adaptation to dominant frameworks. BOs therefore raise unavoidable political and ethical questions.

Third, BO theory concerns cooperation. But who determines the goals of cooperation, and who decides whether participants fulfill their roles appropriately? In the MVZ case, specimens were collected, identified, and described using standardized forms that Star and Griesemer treated as BOs. Yet such activities are not neutral. They depend upon biological theories and classificatory goals (see Hjørland, 2023; 2025b). If all participating “social worlds” were equally involved in designing classificatory standards, the scientific goals of the institution might become impossible to maintain. It therefore seems more plausible that many of the standardized forms functioned prescriptively, suggest-

ing that BO theory may inadvertently reintroduce implicit political agendas while simultaneously presenting itself as neutral.

4. Criticism of the BO Concept

Although criticism has already been discussed in earlier sections, the present section introduces four additional criticisms of the BO concept:

(1) the criticism raised by Huvila et al. (2017), focusing primarily on the lack of conceptual specification;

(2) Smith’s (2015) critique concerning the ontological status of objects;

(3) Huvila’s (2011) discussion of the inevitable political and non-neutral nature of BOs; and

(4) Margolis and Blomsma’s (2023) criticism that BOs are predominantly described retrospectively rather than developed prescriptively.

4.1 A General Criticism of BO

Huvila et al. (2017) argued that both the notion of the BO and its use in the literature require critical examination. They wrote (p. 1817):

“[E]ven if Star (2010) emphasizes the contrary,²² the comfortability of the notion seems also to have made it too easy to claim that almost everything is a BO without any further consideration of whether the claim holds or has any analytical validity, relevance, or implications. Claiming that something is a BO is not an extremely useful observation if this particular framing of a specific thing does not help to understand its nature or function. Finally, the diversity of the use of the BO concept makes it deeply problematic.”

This criticism resonates with the argument advanced earlier in the present article: the examples provided by Star and Griesemer (1989) are difficult to operationalize because the authors do not explain why one representation—for example, one map design rather than another—would better facilitate understanding between groups while still adequately serving the needs of each group involved.

4.2 Smith’s Criticism of the Concept of “Object”

Another critique of the BO concept was advanced by philosopher and cognitive scientist Brian Cantwell Smith in a 2015 book chapter entitled “So Boundary as Not to Be an Object at All”.

Smith’s criticism is rooted in his broader philosophical work on the nature of objects and on the processes through which humans come to regard things as objects.²³ For Smith, objects are not neutral, fixed entities existing independently in the world, but are products of practices

of interpretation, categorization, and situated engagement. From this perspective, the very notion of a BO presupposes that objects possess sufficiently stable identities to remain “the same” across different communities and interpretations.

Smith’s concern is therefore that once something is treated as an “object”, it tacitly acquires the status of a stable referent moving intact across boundaries. This invites a quasi-neutral interpretation, even if neutrality is officially denied. Yet, according to Smith, what we call objects are themselves already outcomes of interpretation and practice rather than ontologically prior realities.²⁴ As Smith asked (Liz²⁵ [Goodman], 2011):

“Boundary objects—plastic but robust. This seems like an innocent statement. From what perspective is it uttered? But ‘robust enough’ is tricky. If you were a realist, you would think ‘robustness’ is a stable attribute of the object. But you’re not.²⁶ The stabilization of the object as an object—those are specific to the parties. So where are you among those parties?”

Smith’s criticism therefore suggests that Star never adequately specifies the perspective from which a BO is considered “robust enough”, nor under what conditions something can legitimately be identified as a BO. As Huvila et al. (2017, p. 1816) similarly observed, “the BO-ness of any given thing depends on how it functions in a situation”.

4.3 The Political Nature of BOs

The abstract of Huvila (2011, p. 2528) explicitly states that the article “demonstrates and discusses the political and purposeful nature of boundary objects—how they are devices for creating and maintaining hegemonies within communities and achieving authority over other intersecting groups of people”. It is noteworthy that precisely such “imperialist imposition of representations” was what Star and Griesemer (1989, p. 413) originally contrasted BOs with.

Taken together, the criticisms advanced by Huvila and Smith reveal a fundamental weakness in the BO concept as developed by Star (1988) and Star and Griesemer (1989), later elaborated by Star: The failure to consider the political nature of BOs: that a common goal of the cooperation must determine the nature of the BO. This weakness becomes especially clear when considering concrete cases involving competing theoretical frameworks.²⁷

A particularly relevant example is biological taxonomy. The traditional Linnaean hierarchy continues to offer important practical advantages and remains widely used, yet it competes with cladistic approaches. Different user groups clearly require different classificatory principles, but no single system has succeeded in simultaneously satisfying the advocates of both approaches. From a cladistic

perspective, for example, retaining the category “fishes” consistently would require the inclusion of mammals and human beings, since cladistic classifications reject paraphyletic groups (see Hjørland, 2025b, pp. 13–14).

The point is not whether cladistics or Linnaean taxonomy is correct, but that different theoretical frameworks generate incompatible classificatory consequences. This example illustrates the difficulty of developing concepts such as BOs without systematically relating them to concrete empirical and theoretical controversies discussed in the scholarly literature.

4.4 A Criticism of the Predominantly Retrospective Use of BOs

Margolis and Blomsma (2023) observed that BOs are usually studied retrospectively on the basis of ethnographic or historical material. They argued, however, that the concept could instead be developed into a prescriptive framework capable of supporting tool development in cross-sectoral collaboration. This distinction may also be described as:

- retrospective versus prospective,
- descriptive versus prescriptive,
- or ex post versus ex ante.

The authors wrote (p. 1):

“Boundary objects share the capacity to embody, visualise, or articulate aspects or dimensions of a topic across different communities of practice. That is, they are comprehensible to different actors and make accessible what would otherwise remain implicit. Therefore, boundary objects play a key role in cross-sectoral collaboration (CSC) as they support shared framing, social learning, and coordination of action.”

According to Margolis and Blomsma, BOs are characterized by five properties (some of which were not explicitly formulated in the original BO literature):²⁸

1. They are plastic enough to integrate different viewpoints and uses.
2. They enable learning because they are organized around information, knowledge, and classification requirements.
3. They help coordinate work.
4. They are adapted to collaboration processes.
5. They exist across different scales and levels of granularity.

Margolis and Blomsma use these characteristics as design principles for developing tools intended to function as BOs and provide evaluation questions for determining whether a given artifact fulfills such criteria.

For example, the criterion “plastic enough” is examined through questions such as:

1. Does the tool help indicate common leverage points?

2. Does the tool help articulate tensions in goals and align participants around a common system frame?

Similarly, the criterion concerning adaptation to collaboration processes is examined through questions such as:

1. How does the BO connect to the broader collaborative infrastructure?

2. Do participants possess the skills and knowledge required to work with the BO?

3. Are participants sufficiently motivated to engage in the collaboration?

Of course, this specific framework may itself be questioned. One may ask whether the proposed criteria are theoretically well founded and whether the evaluation questions are either necessary or sufficient. Nevertheless, the approach appears fruitful, if not necessary, for clarifying what a BO actually is.

As Huvila et al. (2017, p. 1817) argued, “Claiming that something is a BO is not an extremely useful observation if this particular framing of a specific thing does not help to understand its nature or function.” By shifting from retrospective to prescriptive use, Margolis and Blomsma’s framework forces a more explicit specification of the BO concept. Without such specification, the concept risks degenerating into the trivial claim that anything used by multiple groups qualifies as a BO.

A more fundamental counterargument is that Star did not conceive BOs as artifacts intentionally designed by information professionals or similar specialists. Rather, she regarded them as emerging organically through cooperation among actors themselves. While this observation is correct, researchers and practitioners employing the BO concept must nevertheless possess sufficiently clear criteria for identifying BOs. In practice, this requires a level of conceptual specification comparable to that demanded by prescriptive frameworks.

5. Application in Information Science and KO

Huvila et al. (2017) provided a broad overview of the use of BOs in information science, identifying the following five areas:

- Knowledge organization
- Information practices
- Documentation
- Social informatics
- Computer-supported cooperative work

The present article does not attempt to address all these subfields, for which Huvila et al. (2017) remains a highly valuable review. Instead, the focus here is on knowledge organization (KO).

Huvila et al. (2017, p. 1811) wrote:

“Star’s theoretical sensitivity to the social, historical, and cultural influences surrounding the development of classification systems (cf. Bowker and Star, 1999)²⁹ has since been combined in classification research using domain-analytic approaches (cf. Hjørland and Albrechtsen, 1995) to study bibliographic classifications (Caidi, 2004; McTavish and Fortier, 2011). In a departure from earlier extensions, these studies feature close reading and textual analysis focused on the term level in relation to social contexts. Here we see how additional theoretical refinements presented in Bowker and Star (1999) are extended to knowledge organization studies for analytical goals, thereby broadening their relevance.”

This quotation highlights an important aspect of Star’s work: her sensitivity to the social, historical, and cultural influences shaping classification systems. Similarly, Albrechtsen and Jacob (1997; 1998) argued that BO theory represented an alternative to earlier approaches in KO grounded primarily in rationalism and empiricism. In contrast, BO theory treated knowledge as a historical, cultural, and social product.

The well-known book *Sorting things out* (Bowker and Star, 1999) bears the subtitle *Classification and Its Consequences*. To foreground consequences is already to adopt a pragmatic or political perspective. Let this therefore be stated explicitly: constructing or evaluating a classification system—or any knowledge organization system (KOS)—cannot consist merely in applying logical principles, as in logical division or facet analysis, nor simply in grouping entities according to shared properties, as in statistical or empiricist approaches.

A third family of approaches comprises historicist perspectives emphasizing genealogical,³⁰ socio-cultural, and paradigmatic contexts, as exemplified by cladistics in biology or paradigmatic analysis in Ørom’s (2003) study of art classification. Finally, pragmatic approaches to classification treat goals, values, interests, policies, and consequences as integral components of classificatory methodology (see also Hjørland, 2017a, §4.2c, on these four approaches). From this perspective, Bowker and Star’s book may be interpreted as an expression of a pragmatic approach to classification.

As discussed earlier, Star and Griesemer (1989) examined how the MVZ collected, described, and classified animal specimens. Some researchers within KO occasionally suggest that such activities concern the organization of physical objects rather than knowledge organization proper,

implying that they belong to separate domains of expertise. This view is misleading and deserves correction.

A bibliographic classification system such as the Dewey Decimal Classification (DDC), for example, cannot classify documents concerning plants or animals independently of how plants and animals are classified within biology itself. Green and Martin (2013), for instance, examined how developments in botanical classification affected revisions to the DDC. The principle that bibliographic classifications should correspond to “scientific and educational consensus” was already formulated by Bliss (1929, p. 16). Although this principle has often been compromised because of (1) the practical need for classificatory stability; and (2) the difficulty of acquiring sufficient subject expertise across domains, it has rarely been explicitly rejected.

KO is fundamentally concerned with criteria for the optimal identification, naming, description, and ordering of informative objects. It is now widely accepted that even animals may function as “documents” or “informative objects”, as illustrated by Briet’s ([1951] 2006) famous claim that an antelope in a zoo may be regarded as a document.

From this perspective, several important issues in biological classification ignored by Star and Griesemer (1989) become highly relevant.

5.1 Natural Versus Artificial Classification

Within the philosophy of classification, the distinction between natural and artificial classifications is well established (cf. Hjørland, 2025b). Artificial classifications may be optimal for particular purposes, whereas natural classifications are generally assumed to support broader and more general explanatory goals. This distinction has been largely absent from the BO literature, just as discussions of concrete scientific classifications—such as the periodic table or biological taxonomy—have rarely been analyzed through the lens of BO theory.

The tension is especially visible in ornithology, where cladistic approaches compete with more traditional Linnaean classifications. Lovette (2016, §2.1.4) distinguished:

- the biological species concept, emphasizing reproductive isolation; and
- the phylogenetic species concept, emphasizing common ancestry and shared evolutionary history.

As Lovette further noted (§2.1.2), every branching point in avian evolution could in principle define a phylogenetic species. Yet assigning names to all such branches would generate thousands of continuously changing taxa. Consequently, most ornithological classifications retain a reduced set of hierarchical Linnaean categories such as genera, families, and orders.

Although these higher-level boundaries are partly arbitrary and historically contingent, they provide practical stability and manageable taxonomic organization. Modern ornithological classifications therefore typically revise Linnaean systems in light of cladistic findings while retaining

the Linnaean representational framework itself. This creates a persistent tension between:

- theoretical rigor (cladistics), and
- practical stability and usability (traditional Linnaean hierarchy).

An analogous conflict exists within the DDC between preserving the “integrity of numbers” and “keeping pace with knowledge” (cf. Hjørland, 2025a, §2.13).

No single classification can fully satisfy both specialists interested in precise evolutionary relationships and amateur ornithologists engaged primarily in observation or citizen science. Contemporary ornithological classifications therefore function less as syntheses of competing theories than as cladistic reinterpretations of an inherited Linnaean infrastructure. Such classifications may indeed be interpreted as BOs in Star’s sense: they function as interface representations enabling coordination among heterogeneous epistemic communities by translating cladistic evolutionary knowledge into a historically entrenched classificatory framework. They do not constitute neutral common ground, nor do they resolve underlying theoretical tensions. Rather, they represent stabilized and institutionally mediated translations that enable practical cooperation while preserving epistemic disagreement.

At present, this BO appears to function reasonably well, although its limitations correspond precisely to the advantages emphasized by advocates of the PhyloCode (cf. Cantino and de Queiroz, 2020).

5.2 The Theory-Laden Nature of Descriptions

As reported by Ogilvie (2006, p. 207), plants prior to the Renaissance were primarily described for medical purposes, emphasizing properties such as color, odor, and taste. Renaissance naturalists increasingly sought to distinguish essential from superfluous features, producing more detailed morphological descriptions while gradually excluding qualities previously regarded as important.

They also increasingly described organisms outside their natural contexts, especially within collections. Ecological and relational forms of classification emerged much later, particularly in the nineteenth century, when ecology required organisms to be understood in relation to environments and systems of interaction. This historical development demonstrates that neither descriptions nor classifications are neutral. Any museum collection must balance at least two competing requirements:

1. continuity and representational predictability;³¹ and
2. adaptation to scientific developments.

Within the DDC, this tension is often expressed through the principle of “keeping pace with knowledge” (cf. Dewey, 2011, p. xxi).

5.3 The Importance of Voucher Specimens

Another principle essential to museum collections concerns biologists' reliance on archived specimens. Newly identified species are formally recognized through publication, and the first valid description establishes the official status of the species. A central requirement is that the description be linked to a reference sample or "voucher specimen".

The type specimen functions as the bearer of the scientific name by connecting:

- the physical specimen,
- the name,
- and the published description.

This practice reflects an important epistemological insight: specimens once believed to belong to the same species may later be reclassified as distinct species. This insight emerged after Carl Linnaeus, who did not consistently prioritize preserving original specimens and sometimes replaced them with what he considered "better" examples.³²

These examples illustrate theoretical issues involved in the collection, description, and organization of preserved objects in natural history museums. Any particular museum can satisfy the needs of different user groups only partially. Researchers cannot expect museum collections to be tailored entirely to their own requirements, but must instead work with inherited collections that may function as BOs in Star's sense.

From the perspective of KO, however, it is insufficient merely to observe that a museum functions as a BO. KO must instead engage critically with the problem of how such systems and processes ought to be designed and improved.

Thomas Kuhn's concept of taxonomic incommensurability (cf. [Oberheim and Hoyningen-Huene, 2025](#), §2.3.1) holds that competing paradigms rely upon incompatible classifications of natural kinds, thereby producing translation failures. If KO ignores such issues, it risks remaining philosophically naïve. The construction and evaluation of classifications—whether conceived as BOs or otherwise—therefore require explicit understanding of the competing conceptual and philosophical positions operating within the relevant domain.

6. Conclusion

While the concept of BO has remained unclear in the literature, the theory associated with it has contributed to an increased understanding of "interpretive flexibility", to a higher level of theoretical sensitivity to the social, historical, and cultural influences surrounding the development of classification systems and other KOSs, and to the study of the roles KOSs can serve as bridges between different groups of people. Part of the success of the BO concept is probably linked to its origin in the STS field, which, in the late 1960s and 1970s, emerged as a major and influential alternative to the view of science as an "internal", purely rational march toward truth isolated from society. STS ar-

gued that scientific facts and technological artifacts are socially constructed and inseparable from their political, economic, and cultural contexts. It thus presented an alternative to the basic assumptions of logical positivism, although it has often conflicted with the views of both philosophers and scientists, culminating in the so-called "science wars" (see, e.g., [Brown, 2001](#)). A major criticism of STS is its tendency to be purely descriptive rather than explanatory or normative, which fits well with the criticism of BO provided in the present article.

A major point in the present article is an analysis of the relation of BOs to developments in the philosophy of science, which Galison characterized in terms of three periods labeled "logical positivism", "anti-positivism", and "anti-reductionism". The BO concept was influenced by "anti-positivism", particularly in the form of the constructivist approach in the sociology of science, which promoted the idea of interpretive flexibility. This anti-positivism was, however, not consistently implemented by Star, because BOs were considered neutral means of translation between incommensurable views, rather than being considered "imperialist imposition[s] of representations, coercion, silencing and fragmentation". BO theory thereby smuggled the logical empiricist view of a neutral observation language into the process of cooperation.

Star and Griesemer demonstrated how BOs were identified retrospectively in relation to objects used by different cooperating agents, but did not show in detail how the "translations" between different views were actually accomplished. It seems too easy to claim that, if different groups have used the same object, that object is thereby a BO. As Huvila et al. (2017, p. 1817) wrote: "[T]he vagueness of how the notion has been defined using examples and the metaphorical rather than constitutive nature of references has invited a noncritical and sloppy use of the concept." The related concept of "trading zones", introduced by Peter Galison, better demonstrated that different and irreconcilable epistemologies can nevertheless contribute to solving a common problem (the construction of the first atomic bomb), and more clearly illuminated how trading zones—and thereby implicitly BOs—managed translation between different groups.

Star's later article, *This is not a boundary object* (Star, 2010), is written as a restatement of the articles from 1988 and 1989 but is interpreted here as a partially reinterpretive discussion. Between the original 1988/1989 articles and Star's retrospective reflections in 2010, *Sorting things out* (Bowker and Star, 1999) was published, emphasizing infrastructures and their consequences. While Star and Griesemer's (1989) notion of boundary objects is often taken to demonstrate how heterogeneous communities can cooperate through shared artifacts, Bowker and Star (1999) complicated this picture by emphasizing that classification systems, as infrastructures, "valorize some point of view and silence another" (p. 5). Such systems are embedded,

learned as part of membership, and taken for granted in practice (p. 35), meaning that participants must adopt their categories in order to function. The apparent interpretive flexibility of boundary objects is thus constrained by underlying classificatory regimes, which shape what can be represented and recognized. When categories do not fit, users experience “torque” (p. 195),³³ indicating that cooperation is achieved not through neutral mediation but through adaptation to historically sedimented and often asymmetrical representational frameworks. Taken to an extreme, one could say that the structures used in cooperation (formerly often considered BOs) may indeed be regarded as “imperialist imposition[s] of representations, coercion, silencing and fragmentation”.

We interpret Bowker and Star (1999) as grounded in a pragmatic epistemology, understood as a view that considers the goals, values, interests, policies, and consequences involved in research. This includes both the goals and theories guiding researchers and the people, classifications, and other entities they study. Objects such as classification systems are thus analyzed in terms of the often implicit theoretical assumptions that have influenced their design. We therefore agree with Bowker and Star’s (1999) insistence that classification systems and other objects used in cooperation are moral and political technologies. From the perspective of KO, however, it is important to add that such objects are not merely *faits accomplis* to which users and information professionals must adapt; they are also epistemically optimizable. In every domain of knowledge, struggles over classification persist, and such struggles are deeply embedded in theoretical and policy issues within the domain. Information professionals do not work outside these struggles, but are themselves participants in them.

Availability of Data and Materials

This is a theoretical paper; no datasets were generated or analyzed. All sources used are cited in the references.

Author Contributions

BH confirms sole responsibility for the conception and design of the study, data collection, analysis and interpretation, drafting and revising the manuscript, and approval of the final version. The author has read and approved the final manuscript and agrees to be accountable for all aspects of the work.

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Declaration of AI and AI-Assisted Technologies in the Writing Process

The manuscript was reviewed using ChatGPT 5.5 as an AI-assisted language-editing tool. The review focused on grammar, style, readability, and idiomatic academic English, while substantive scholarly responsibility for the text remained with the author. All suggestions made by ChatGPT were considered by the author.

Endnotes

¹When quoted in text it is quoted as Star (2015), to which the page numbers refer.

²On January 16, 2026, the Web of Science Core Collection listed 2751 publications containing the term “boundary object*” in the Topic field. Of these, 476 were categorized under Management, 288 under Education and Educational Research, 264 under Environmental Studies, 233 under Environmental Sciences, 225 under Computer Science and Information Systems, 191 under Information Science and Library Science, 176 under Business, 146 under Computer Science Theory and Methods, 129 under Computer Science Interdisciplinary Applications, and 128 under Social Sciences, Interdisciplinary.

³Guimarães (2017), following Oxford English Dictionary defined: “slant” as “a particular point of view from which something is seen or presented”.

⁴A blackboard in a distributed artificial intelligence system works as a shared, central repository where multiple specialized, independent agents collaborate to solve complex problems by reading from and writing to this space. It operates similarly to human experts in a room using a physical blackboard: one expert adds a partial solution, which triggers another expert to refine it, iteratively building toward a final solution (see Schepis, 2025).

⁵Star (2010, p. 604) wrote: “Since the publication of the original boundary object papers some twenty years ago, many other forms have been suggested: textbooks, performances, computer operating systems, and various aspects of design. I have never made any attempt to adjudicate or prevent how anyone uses the concept. It has felt a bit unseemly, perhaps, contrary to the original spirit of the development of the concept itself.” However, by not attempting to do so, she contributed to the conceptual vagueness of the term, so that anything can be taken as a BO because it cannot be said what a BO is not.

⁶Griesemer (2015, p. 208) later acknowledged: “Leigh brought the boundary object idea and I brought the material grounding of these object conceptions—specimens and species, environments and evolution, for example, to our joint work of methodological need.” And (ibid., p. 205): “Leigh Star (she was the brains of our operation)”.

⁷Star and Griesemer (1989) include an endnote (their note 16) referring to Griesemer (1990), who argues that abstraction in science—specifically in biology—is not primarily a cognitive or formal operation, but a material and practical process embedded in scientific work with concrete objects. In addition, the endnote also refers to Cartwright and Mendell (1984), who argue that objects in physics acquire abstraction through idealization, whereby models ignore complex real-world features to focus on essential laws. Concepts such as the “laser” or a “frictionless surface” are thus theory-laden and meaningful only within specific theoretical frameworks, rather than existing as purely empirical entities.

⁸This list of five characteristics of BOs mentioned by Star and Griesemer (1989) is cited here from Huvila et al. (2017, p. 1808), who also provides a comprehensive review of how the term *boundary object* has been used in the literature. Their Table 1 (p. 1808) lists 23 examples, with references ranging from “activities” to “water”.

⁹Star and Griesemer (1989, p. 389) wrote: “The problem of translation as described by Latour, Callon and Law is central to the kind of reconciliation described in this paper. 3 In order to create scientific authority, entrepreneurs gradually enlist participants (or in Latour’s word, ‘allies’) from a range of locations, re-interpret their concerns to fit their own programmatic goals and then establish themselves as gatekeepers (in Law’s terms, as ‘obligatory points of passage’). 4 This authority may be either substantive or methodological. Latour and Callon have called this process *interessement*, to indicate the translation of the concerns of the non-scientist into those of the scientist. Yet, a central feature of this situation is that entrepreneurs from more than one social world are trying to conduct such translations simultaneously. It is not just a case of *interessement* from non-scientist to scientist. Unless they use coercion, each translator must maintain the integrity of the interests of the other audiences in order to retain them as allies. Yet this must be done in such a way as to increase the centrality and importance of that entrepreneur’s work. The n-way nature of the *interessement* (or let us say, the challenge intersecting social worlds pose to the coherence of translations) cannot be understood from a single viewpoint.

¹⁰Other STS researchers, in particular Latour (1987; Latour and Woolgar, 1979), especially studied such translation processes in greater detail.

¹¹Star (2010, p. 602) found that “Interpretive flexibility has been one cornerstone behind much of the “constructivist” approach in recent sociology of science”, which is correct, but it is also an important part of philosophies such

as that of Thomas Kuhn, of historicism, hermeneutics and pragmatism.

¹²What makes it hard to examine Star’s work is, for example, Star’s (2010, p. 602) claim that Star and Griesemer (1989) used the terms “granularity” and “information needs”, which cannot be found there. Such inaccuracies further support interpreting the 2010 article as a reinterpretation rather than an unmodified version of the original BO concept.

¹³Griesemer (2015, p. 207) does cite Galison (1997) but just made a small extension of his understanding of “language”, without seriously engage in his views. Láng and Megyesi (2024) mentioned that they found the concepts of trading zones and BO particularly fruitful and described their origin and meaning. Collins et al. (2007) provides one of the most important analyses between trading zones and BOs and further develop Galison’s view on the development of BOs and the gradual reduction of the cultural differences between the different disciplinary participants. Kemman (2021) discusses both Galison and Star extensively, especially in relation to Star’s research on infrastructures, but it does not compare the theoretical positions of these two authors.

¹⁴Galison (2010, p. 46) description of Star and Griesemer’s BO is broadly faithful in spirit but imprecise in detail, as (1) MVZ is a museum for zoology (vertebrates), not botany; (2) Star and Griesemer emphasize heterogeneous participation, explicitly cooperation between amateurs and professionals, not amateur activity alone; (3) Star and Griesemer did not consider how professionals in different fields used the samples of MVZ in different ways.

¹⁵Galison (2010) also writes that “the archival flora collections didn’t, in the long run, become a field in their own right, for a collection is not a discipline”. This claim is not discussed here, as it raises questions concerning the influence of disciplines on collection management and whether collection management itself may generate knowledge.

¹⁶Galison (1997, p. 784) includes footnote 4, which reads: “While Carnap himself enriched this view considerably with varying forms of ‘structuralism’ and conventionalism [...], it was this ‘bedrock’ view that was more widely associated with his work among both historians and philosophers.”

¹⁷Brown (2005, p. 152) writes: “[O]bservation and logic are not sufficient to resolve disputes between fundamental theories (Kuhn, 1962, p. 93; Kuhn, 2000b, p. 204); additional methodological criteria are required, and these additional criteria are internal to specific theories [...] The key point is that we do not have a theory-neutral set of methodological rules that will allow us to compare competing theories. Presumably, this problem would remain even if we had a relevant body of theory-neutral data.”

¹⁸It is widely acknowledged that Kuhn introduced a historical turn in the philosophy of science by insisting that

understanding science requires close attention to its actual historical development, rather than an exclusive focus on its logical or formal structure. Kuhn, Hanson, and Feyerabend were not historicists in the traditional sense, but all emphasized the theory-laden character of observation. In this respect, their views converge on the idea that cognition is historically and socio-culturally situated, and that such contextual factors must be taken into account in philosophical analyses of scientific knowledge. This position may therefore be described as a methodological form of historicism.

¹⁹This view contrasts with Szostak's (2008, p. 98) claim: "As interdisciplinary scholarship has shown, disciplines and subdisciplines are each characterized at any point in time by a narrow shared set of 'acceptable' theory and method."

²⁰Galison (1997, p. 781), for example, writes: "I will argue this: science is disunified, and—against our first intuitions—it is precisely the disunification of science that brings strength and stability. This argument stands in opposition to the tenets of two well-established philosophical movements: the logical positivists of the 1920s and 1930s, who argued that unification underlies the coherence and stability of the sciences, and the antipositivists of the 1950s and 1960s, who contended that disunification implies instability."

²¹Bruno Latour, Michel Callon, John Law and others introduced what they call *Actor-network theory* (ANT) treating humans, technologies, objects, ideas, and natural elements as equally important "actors" or "actants", in contrast to conventional theories focusing primarily on human agency. Star and Griesemer did mention animals among the agents, but this theoretical point was not developed, and BO was not discussed as a concept in which one group of actors were animals. ANT is criticized for, among other issues, to provide pure descriptions rather than explanations, an issue the present article also raises against Star's BO theory.

²²Star (2010) notes the misuse of the concept of boundary objects, observing that many researchers have focused solely on "interpretive flexibility", thereby misapplying the concept to almost any object that appears to bridge two groups.

²³Smith's critique is consistent with his broader work, notably *On the Origin of Objects* (1996), which argues for an "embedded, participatory, irreductionist" alternative to traditional formal metaphysics.

²⁴Levina (2005, p. 112) wrote: "While the term 'object' is not defined in the literature on boundary objects, I draw on practice theory to define objects as symbolic representations of practices. Moreover, common identity of an artifact refers to an artifact serving as a common symbolic resource for diverse agents. These ideas are further developed in Levina and Vaast (2005)."

Star (2010, p. 603) wrote: "In the term 'boundary object', I use the term object in both its computer science

and pragmatist senses, as well as in the material sense. An object is something people (or, in computer science, other objects and programs) act toward and with. Its *materiality* derives from action, not from a sense of prefabricated stuff or "thing"-ness. So, a theory may be a powerful object. Although it is embodied, voiced, printed, danced, and named, it is not exactly like a car that sits on four wheels. A car may be a boundary object but only when it is used between groups in the ways described above."

²⁵*Liz* is a pseudonym and refers to information researcher Elizabeth Goodman (cf. <https://www.confettiou.s.net/>).

²⁶Smith indicates that he is aware that Star is not a realist; nevertheless, he argues that there is an internal tension in her theory of boundary objects insofar as it appears to presuppose objects as "given" rather than as constructed.

²⁷Star (2002, p. 116) wrote about the "fierce debate between gay activists and psychiatrists about the medicalization of the category 'homosexual' as an illness in early versions of the Diagnostic and Statistical Manual (DSM), the psychiatric equivalent of the International Classification of Diseases (ICD). The DSM assigns categories to mental illnesses, and is widely used in psychiatric epidemiology as well as in such crucial infrastructural functions as third party reimbursement for psychiatric care. At the same time, few on either side of the debate quarreled with the basic need for such a category system. Once the system was put into place, it acquired its own inertia and entanglements with the everyday bookkeeping and diagnostic practices of psychiatrists and other mental health professionals." Although there exist professionals, especially within "humanistic psychology", that criticize not just a specific classification such as the DSM, but the very idea of classifying mental disorders, I think Star is right that classification in the end is inevitable. Nevertheless, Star blurs the theory-dependence and political nature of classifications by considering the basic categories in any discipline (as reflected in thesauri and other KOS) as neutral foundations that can function as BOs. I strongly disagree in this quote (ibid., p.115): "In none of these sorts of debates, however, are the basic terms of the debate questioned."

²⁸Margolis and Blomsma's characterization of BO is in my assessment, partly a reconstruction by the authors rather than a straightforward description derived from the literature. It is a synthesized, modernized, and partly the authors' own normative reconstruction. The original BO core (Star, 1988; Star and Griesemer, 1989) emphasized plasticity and coordination; Star's (2010) reinterpretation emphasized information/work requirements and granularity; whereas 'learning' and 'adaptation to collaboration processes' appear to be additions introduced by the authors. Especially "enable learning" and "adapted to collaboration process" seems to move BOs toward organizational consulting language, far from the original MVZ case.

²⁹What Huvila et al. (2017) referred to as Bowker and Star (1999) is the same book which we refer to as Bowker and Star (1999).

³⁰For the genealogical approach to classification, see Gnoli (2023).

³¹Fugmann (1985) formulated the axiom of representational predictability as a foundational principle in information retrieval and indexing theory. It explains why certain search strategies succeed or fail by stating that the success of any directed search for relevant information depends on how accurately a searcher can predict the “modes of expression” (i.e., the vocabulary, terminology, or indexing terms) used to represent concepts in the search file.

³²Law and Lynch (1988), and Lynch and Law (1999), examine how scientific observations—illustrated through bird-watching—are not simply direct reflections of nature, but are actively constructed through social practices and the use of mediating artifacts such as field guides, illustrations, and species lists.

³³Bowker and Star (1999, pp. 187–196) introduced the concept of “torque” to describe the social and psychological strain produced when individuals are compelled to fit institutional classification systems that inadequately represent their situations. The concept illustrates that classification systems are not neutral infrastructures but may exercise asymmetrical normative power over their users.

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