

Authorship and documentary boundary objects

Isto Huvila

Department of ALM, Uppsala University

isto.huvila@abm.uu.se

Abstract

Earlier research on documentary boundary objects has ^{Text} underlined the contextual nature of the process of their emergence. The aim of this paper is to discuss how the process of making and the attribution or non-attribution of authorship affects documentary boundary objects. A better understanding of the making of boundary objects is helpful in understanding why and how particular boundary objects work, and what are their implications. The article proposes an analytic model of four modes of authorship of documentary boundary objects (1. solitary, and 2. emergent authorship, 3. light-weight, and 4. heavy-weight peer-production) based on a review and synthesis of the spectrum of solitary and collaborative practices of creating documentary boundary objects discussed in the literature.

1. Introduction

The contradictory remarks on the democratising and detrimental effects of new types of digital documents from wiki articles to status messages and digital pieces of music is an indication of their significance in the contemporary culture. At the same time, the comments assert the complexity of the activities the different types of digital documents are “summoned to perform” [1]. Documents make difference, and more precisely, as Murphy implies using the term “summon”, they are *made* to do so in a liminal space between different communities of interest. As earlier studies have shown (e.g. [2][1]), the betweenness makes documents potentially powerful boundary objects (BO) that may help them to bridge gaps between groups of people and function as shared “portable places” for virtual, non-physically based, communities [2]. In spite of the interest in the emergence of documentary BOs (DBO) in specific contexts (e.g. [2][3]), the earlier research has largely bypassed the question of making systematic remarks on the general patterns of the emergence of BOs. A better understanding of the making of BOs is helpful in understanding why and how particular BOs work, and what are their implications for neighbouring communities. There is a difference if a BO is essentially

imposed by a single individual or if it is a result of a certain type of collective endeavour.

The aim of this paper is to discuss the role of authorship in the emergence of DBOs. On the basis of a review and synthesis of earlier empirical and theoretical literature, I am proposing a model for categorising existing and emerging solitary and collaborative practices of creating DBOs on the basis of their authorship. The present study expands the earlier observations of the social and contextual complexity of BOs [4][5] by arguing that their dynamics are closely related to the social and cultural, both individual and collaborative, practices of their creation as BOs i.e. as a separate process from their authorship as documents. The theoretical underpinnings of the paper are in social constructivism and new document theory [6]. Accordingly, documents are perceived as socially constructed entities that serve a documentary function [7] and BOs (in an essentially analytical sense) as entities with a function as BOs [8]. Further, the study builds on the notions of authorship and attribution [9], and the typology of peer-produced knowledge production of Haythornthwaite [10].

2. Documents and authorship

A central premiss of document theory is that documents are a result of ‘documentation’ [6], i.e. a process of turning an abstract or physical object to a representation of something. The well-known reference to an antelope as a document in the classical text of Briet exemplifies the process. According to Briet [11], an antelope becomes a document of a specimen when it is placed in a zoo. The example emphasises the significance of documentation (the *process* of moving an antelope) and authorship (the role of *someone* who moves the antelope).

In spite of the outspoken significance of documentation (activity), the dominance of an information centric viewpoint and a focus on information seeking and retrieval seem to have marginalised the interest in authorship [6]. In contrast, authorship has been a central topic of discussion in literature studies and more recently, in the context of copyright (e.g. [12]) and e-Science research (e.g. [13]), and, for instance, eth-

nography (e.g. [14]). In simple terms, authorship is a question of determining and acknowledging who is a creator of a document. Hemmungs Wirtén shows, however, that the prevalent myth of solitary authorship and the consequential assumption of an ownership are deeply problematic concepts. Technologies from xerography to the more recent digital innovations have underlined its flaws, and consequently, had a major impact on the gradual deconstruction of the myth [12]. Instead of a form of an unambiguous intellectual ownership and parenthood, authorship may be seen as a question of a social attribution [9] of certain privileges and liabilities [15] that is often more significant association than the actual creatorship of a document.

The significance of the social dimension of creating a document (in the process of documentation) is apparent already in the work of Briet and other early documentalists. The act of documentation by placing an antelope in a zoo and the role of zoos are necessarily based on a social contract. The significance of documents as socially constituted entities has been further emphasised in the context of social document theory [7]. Instead of emphasising social authorship, the theorising on social documentary practices has tended to focus on the significance of the reception and the active role of documents. Brown and Duguid [16] and Star and Griesemer [3], and consequently, the literature on DBOs share a Latourian [17] emphasis of the agency of documents in their context of creation and use. A conscious deemphasis of authorship is especially explicit with Fish who perceives documents as an “open category” and claims that the impact of a document is determined by its audience [18].

In spite of the extremity of the viewpoint of Fish [18], the claim is a useful reminder of the limits and fluidity of authorship and attribution. As Brown and Duguid suggest, the creator determines what is in a document, but the understanding and implications of a document are socially constructed by the people who interpret it [16]. Rather unsurprisingly, the popularity of the theorising of collaboration and the confluence of authorship and reception has increased in the wake of the emergence of new digital technologies that have dramatically changed the physical outlook of documents [19] to a degree that makes them difficult to recognise as such [20]. The convergence of authors and users is especially evident in the interactive forms of media such as games [21]. Nonetheless, as Brown and Duguid [16] propose, the distinction between authors and readers may be argued to remain useful. Equally useful is to make a distinction between different processes of authorship. Even if the physical form and the functioning of documents have changed dramatically, a document is still initiated by someone and it makes analytical sense to make a distinc-

tion between different intensities of collaborative contribution and consumption. Consumption is a significant contribution to the ecology of the community [22] that embraces a document, but as a fundamental form of activity, consumption is different from authorship.

In order to explicate the modes of participatory authorship of digital documents, Haythornthwaite [10] proposes a two-dimensional model of peer-production of knowledge to complement the traditional ideal of solitary production. She characterises the crowd sourcing based, largely ‘mechanical’ co-production of knowledge as Light-Weight Peer-Production (LWPP) and community and negotiation based production as Heavy-Weight Peer-Production (HWPP). She recognises also the presence of a Dual-Weight approach (DWPP), a combination of the two models. In spite of the apparent significance of the new modes of production of knowledge, the emphasis of collaboration and convergence of roles in the digital information culture does not imply the absence of Haythornthwaiteian modes of peer-production in the earlier era of “solitary genius” [23]. Similarly, their prominence does not indicate a premature end of the single authorship or the impossibility of a non-attributable form of emergent authorship [24] in the digital information culture. Divested of the mythical polarisations, the landscape of authorship may be better described as a fusion of different forms of participation. At the present it seems, however, that the deemphasis of individual authorship has led to the substitution of a myth of solitary genius with another equally biased myth of a collaborative genius of ‘anyone’.

3. Boundary objects (BO)

BOs are abstract or physical artefacts that reside in the interfaces between organisations or groups of people. They have a capacity to bridge perceptual and practical differences among communities and facilitate cooperation by emerging mutual understanding [25]. BOs have been seen as a precondition to communication, cooperative work and to having and reaching mutual goals [3]. Star and Griesemer [3] introduced the notion in their seminal work on the historical information practices at the Museum of Vertebrate Zoology, Berkeley. They described BOs as translation devices and argued that their shaping and maintenance is central to developing and maintaining a sense of coherence across communities [3]. Studies have shown that very different types of artefacts including visual representations [26], technical standards [27], cancer [28] and documents [5] may function as BOs.

On the basis of the functioning of diverse BOs, researchers have made several distinctions between various

types of BOs and boundaries. In their study, Star and Griesemer identified four different types of BOs: *repositories of things* (“ordered piles of objects”), *ideal types* (e.g. diagram, atlas), *coincident boundaries* (objects with same boundaries but different contents, e.g. the boundaries of the state of California) and *standardised forms* (e.g. fill-out forms and other devices for standardising work methods) [3]. Briers and Chua [29] introduced the notions of *ideal* and *visionary* BOs. In contrast to ideal BOs, visionary BOs are conceptual and such that cannot be argued against. They may be, for instance, institutionalised codes or ‘best practices’. Garrety and Badham [30] distinguish *primary* (technology) and *secondary* (physical and abstract objects that enable communication between communities) BOs. Carlile [31] makes a further distinction between syntactic, semantic and pragmatic BOs.

A fundamental observation of the BO research is the intricate relation of the characteristics of objects and their behaviour as BOs. As Star and Griesemer [3] noted, ideas, repositories and (conventional) documents make very different types of BOs. A central characteristic of (conventional) documents is that besides being capable of functioning as BOs, they tend to have multiple overlapping roles and are intricately related to other documents (as Østerlund and Boland emphasise [32]). Besides their role as devices of translation and control (i.e. BOs), Brown and Duguid [16] see documents as objects of politics and negotiation, engagement, agency and enabling. The adverse effect of the complexity of documentary artefacts is that it becomes easy to forget them as physical objects [5].

Even if the term boundary *object* may suggest a relative stability, the dynamism of BOs has been discussed in several studies. Drawing on Berger and Luckmann, Gal et al. [4] emphasise the dynamic nature of BOs and their relation to social infrastructures. Star makes a more explicit remark of the link between infrastructures and BOs by conceptualising the emergence and assimilation of BOs as a cyclical process of infrastructural standardisation and emergence of residual categories [8]. Another dimension of the dynamics of BOs is that the objects themselves are similarly produced as any other artefacts. The initial discussion of BOs by Star and Griesemer and the later remarks of Star both put a lot of emphasis on how BOs come into being as a result of deliberate *making*. This is especially obvious with documents in the context of social document theory. They are dependent on agency already by the definition either as literally produced (as documents) or as interpreted (as documents) artefacts. As Brown and Duguid [16] comment the central thesis of Star and Griesemer, together with management and control, the *creation* of BOs is central to the generation

and perpetuation of coherence across communities.

In spite of the clear theoretical and practical benefits of the notion of BO, it has a number of ambiguities and complexities. BOs are not only objects of translation. They can push boundaries by establishing and destabilising procedures [33]. Carlile [31] underlines that they can be used jointly to *transform* knowledge by proposing alternative views. Gal et al. [4], on the other hand, show how BOs function also as resources to form and express social identities. Lee [34] has suggested an additional category of boundary negotiating artefacts to complement the notion of BOs. According to her, BOs are merely an example of the large variety of different types of artefacts can ‘live’ in the space between communities. A central premiss of the present study is a broad understanding of that what a BO can be and how it can behave. BOs are seen as similarly contextual, negotiating and political artefacts as Lee’s [34] boundary negotiating artefacts that are inseparable of social negotiation processes from the moment of their creation to their abandonment.

4. Modes of authorship and documentary boundary objects

Similarly to the literature studies [23], the literature on BOs has plenty of examples of the co-existence of the different modes of the authorship. Some BOs are attributable to individuals and organisations (in the spirit of ‘solitary’ authorship) while some others are a result of collaboration or a process Pearce [24] describes as *emergent authorship*, a non-attributable production of content. At the same time, many of the examples of BOs presented in the earlier literature are borderline cases showing characteristics of multiple modes of production. In spite of the obvious convergence of genres, an analytical distinction of the modes of authorship of BOs can help us to understand their functioning and roles in boundary crossings.

4.1. Solitary authorship

First, I use the notion of *solitary authorship* (SA) to refer to a process of creating DBOs with a single individual or corporate entity as their attributable originator. An illustrative example of an often solitarily authored DBO is a standardised form. As Murphy [1] describes in the context of claims processing, forms are typically authored (by someone and/or by an assignment) to steer how people act. Besides explicit cases of authorship, an explicit attribution can make an essentially collaboratively produced BO to an authored document. For instance, in the study of Murphy [1], technical reports

are discussed as authored documents even if the authoring process is framed by an intensive negotiation with bounding communities: technical teams, marketing and sales professionals and regulatory authorities. Østerlund [2] discusses how doctors author medical histories in the hospital context to influence the communicative setting of their work. Gal et al. [4] describe the introduction of architectural 3D models (created and endorsed by an influential architectural company) to construction projects and how the models functioned as new types of BOs that dramatically changed the earlier patterns of cooperation between the project partners.

4.2. Emergent authorship

Secondly, an *emergent authorship* (EA) of BOs describes the mode of producing BOs without an apparently attributable author or a colloquially articulable context of creation. The mode of production is based on the notion of emergent authorship of Pearce [24] who observed non-attributable forms of authorship in the context of digital games. In spite of the analytical relevance of discussing emergent authorship, 'emergence' means often intentional or involuntary non-attribution or an incapability to assign authorship to a particular individual, organisation or group. Authorship may also have been forgotten or it has become untraceable.

The emergent authorship of BOs is typical in the sphere of religion and folklore. For instance, taboos can be attributed to ancestors or higher beings, but are often treated as emergent representations (i.e. documents) of community norms [35]. The use of the state of California, and more specifically, a generic outline of its borders in the study of Star and Griesemer [3] is an example of an emergent authorship of a DBO. Ruhleder and King [36] describe a similar case. Before the publication of digital text collections, classical scholars around the world worked for decades with same editions of same dictionaries and thesauri. Even if a book itself was authored, its role as a BO that largely delimited scholarship and its extents was an emergent feature of the physical boundaries of the publication and its layout. Mission and vision statements of organisations are another example emergent DBOs. In spite of their collaborative and solitary origins, the mission statements of organisations are often emergent in the sense that they are not attributed to specific individuals or their attribution is explicitly denied within the organisation [37].

4.3. Light-Weight Peer-Production

Third, we argue that the two modes of peer-production of knowledge proposed by Haythornthwaite [10] constitute additional modes of the production of BOs. She exemplifies the *Light-Weight Peer-Production* (LWPP) using NASA Clickworks application and Mozilla bug reporting system as examples. Zooniverse (www.zooniverse.org) projects and ReCaptcha (<http://www.recaptcha.org>) are based on a similar premiss of aggregating knowledge from the input gathered from a large group of ordinary individuals. Besides aggregating knowledge, the collective action generates DBOs.

The identification of craters on Mars by individual contributors in Clickworks produce a collectively authored document of all Martian craters that bridges the participating communities of professionals and amateurs and helps them to continue with the project. In the bug-reporting system, the individual software bug reports generate together a collective document of the non-functional parts of the software and reproduce an understanding of an ideally functioning piece of software. The document incorporated in the bug-reporting system is used as a BO between the users and developers to negotiate a common understanding of the piece of software. The system is similar to the issues register of a proprietary software application discussed by McLeod and Doolin [38].

4.4. Heavy Weight Peer-Production

Haythornthwaite [10] describes *Heavy Weight Peer-Production* (HWPP) by referring to close-knit mailing list communities and as the most long-standing examples, to the academic community and the invisible colleges of scholars. The mailing list communities produce DBOs in form of the on-going discussions. The discussion threads support boundary crossings both by negotiating the interpretation of the content matter and the explicit and implicit social norms of the community. Academic communities rely on multiple types of DBOs including scholarly journals [39] and research "data" [40] that epitomise scientific knowledge and how it is presented and organised. In contrast to light-weight peer-production, the creation of HWPP of BOs depends on a complicated negotiation and consensual merging of individual viewpoints into shared conceptions of boundaries and boundary crossings. In many cases, the resulting DBOs are characterised by features that are typical to the category of ideal types [3].

5. Dimensions of authorship

In addition to two distinct modes of peer production, Haythornthwaite [10] presents Wikipedia as an example of *Dual Weight Peer-Production* (DWPP) enterprise, an approach that combines heavy and light weight aspects. Wikipedia relies on crowds on entering, editing and updating entries and making them relevant by using the encyclopaedia, but at the same time the inner organisation of the encyclopaedic project is based on a virtual community approach with a complex set of rules and norms. In the dual weight approaches, the boundaries are crossed using both light and heavy-weight BOs. Even if Haythornthwaite lists DWPP as a separate category, I have chosen to omit it in the present analysis because it is essentially a combination of two distinct approaches (LWPP and HWPP) instead of being an independent mode of production. Besides the type of DWPP described by Haythornthwaite, plenty of other types of hybrid modes of authorship exist.

In spite of the obvious overlap of categories, I am arguing (agreeing with the analysis of Haythornthwaite in the context of her study) that the distinction of the different modes of authorship makes analytical sense by exposing the complexity and the significance of the differences in the individual processes of authorship of the BOs. In order to explicate further the four types of practices of producing BOs, we will analyse them closer by using the three dimensions of production of knowledge proposed by Haythornthwaite [10]: 1) contribution type, granularity and authentication, 2) individual to group focus, and 3) recognition, reputation, and reward, and the categorisations of BOs from the literature [3][31][29]. The Table 1 presents a summary of the dimensions in the context of the different production practices together with a grouping of the typically co-occurring categories of BOs and modes of authorship derived from an analysis of the examples discussed in the reviewed literature.

On the basis of the characteristic mechanisms of authorship, it is possible to draw parallels between the four forms of information production and the types of DBOs proposed in the literature. The proposed typical types of BOs refer to such categories that are likely to emerge as a result of a particular mode of authoring. However, as with the classification of authorship, it is impossible to draw categorical conclusions of the links between certain types of BOs and modes of authorship because of an overlap of types. In addition, it is conceivable that various other types of BOs (produced using other modes of authorship) may be involved in the process of an emergence of a BO. For instance, the cooperation in Clickworks may be suggested to incorporate also, ideal types (a particular type of crater, HWPP), standardised

forms (user interface, SA) and coincident boundaries (Mars, EA) .

From the point of view of the produced BOs, the *contribution type, granularity and authentication* varies most between LWPP and HWPP. LWPP is based on collecting a large number of individual and atomistic contributions. Contribution is framed by a set of formal rules and the complexity of contributions and their attributes are limited. The form of contributions is typically enforced by the infrastructure (i.e. the system used to collect contributions) and their validity is authenticated by a formula. The resulting BO is a pooled resource, a repository [3] of things that is usable without a need to negotiate differences in purpose. In HWPP, the contributions are negotiated and revised and the type of contributions is based heavily on tacit mastery of the topic. Contributions can be complex and in different forms. Their authentication is based on negotiation and consensus, and the resulting BO is a result of reciprocal arbitration. In contrast to the formality of many DBOs generated by the LWPP, HWPP tends to yield a shared understanding that is vague and complex (rather than formal and simple) enough to satisfy bordering communities. Carlile [31] presents an example of HWPP in sales work when a salesman negotiated product prices, delivery schedules and product specifications together with the upper management of his employer and his customers producing a DBO, a “blue book” with all the information in it.

In SA and EA, the type and granularity of contributions may vary, but the resulting BO is typically contributed in its entirety by a named author (SA, e.g. a form [1]) or an unarticulable entity (EA, e.g. mission statement [37]). Objects tend to be similar to Carlile’s [31] pragmatic BOs: objects, models and maps that present a holistic interpretation of a phenomenon. The objects are also authenticated in their entirety and usually taken as granted (or discarded) because of the perceived authority of the contributor (SA) or the indisputable nature of emergent BOs. In spite of the non-negotiability of the contribution, the product has to be acceptable by all overlapping communities in order to function as a BO similarly to the coincident boundaries type discussed by Star and Griesemer [3]. In SA, it is important that the form of the BO is capable of mediating the contribution over a long distance similarly to the standardised forms (in [3]). Briers and Chua [29] provide an example of a SA boundary documentation, the plant integrated standard cost system, a collection of standards that allowed different stakeholders to discuss the profitability and other issues related to a complicated suite of products manufactured by a company. The standardised and in effect, imposed system performed poorly because its

Solitary authorship	Emergent authorship	LWPP	HWPP
Contribution Type, Granularity and Authentication			
<ul style="list-style-type: none"> • Independent • Addressing unequivocality, tacit and explicit knowledge • Single author(ity) negotiates rules of contribution • Variable contribution attributes • Single form defined by the only author(ity) • Explicit dependence on the author 	<ul style="list-style-type: none"> • Independently connected • Addressing equivocality, tacit and explicit knowledge • Tacitly 'known' rules of contribution and dependence • Delimited contribution attributes • Single form defined by an unknown/unarticulated authority 	<ul style="list-style-type: none"> • Atomistic, independent • Addressing uncertainty, explicit knowledge • Rule-based contribution • Delimited contribution attributes • Single form defined by authority/owner, authenticated by formula • Pooled interdependence 	<ul style="list-style-type: none"> • Connected, revised, negotiated • Addressing equivocality, tacit knowledge • Negotiated contribution • Variable contribution attributes • Multiple forms defined and authenticated by group consensus, norms • Reciprocal interdependence
Individual to group focus			
<ul style="list-style-type: none"> • Attributed • Explicit history of contribution unnecessary; tacit understanding • Single non-negotiated membership • Single-tier hierarchy: authority • Single form defined by the only author(ity) • Independent; discrete contributions 	<ul style="list-style-type: none"> • Unattributed • Unknown history of contribution; tacit understanding • No membership • Single-tier hierarchy: unarticulated authority • Single form defined by the unarticulated author(ity) • No contributions 	<ul style="list-style-type: none"> • Anonymous • History of contribution unnecessary • Open membership; low effort to enter • Two-tier hierarchy: authority, contributor • Independent, repetitive, discrete contributions 	<ul style="list-style-type: none"> • Attributed • History of contribution important for group • Review, gatekeeping to join; high effort for membership • Multi-tier hierarchy: novice to expert • Continuing, contingent, norms-based contribution to product and process
Recognition, reputation, reward			
<ul style="list-style-type: none"> • Quantitative and qualitative external recognition mechanisms • Internally relevant to the individual contributor • (Quantitative and) qualitative measures of contribution 	<ul style="list-style-type: none"> • No recognition • Socially relevant to a community • Assumed quality of the object 	<ul style="list-style-type: none"> • Quantitative recognition mechanisms, e.g., contribution rate • Internally relevant to the individual application or the arena of contribution • Quantitative measures of contribution to product 	<ul style="list-style-type: none"> • Qualitative recognition • Internally relevant, permeable to field of interest • Internal: judgments of contribution quality, expertise; External: judgment of contribution quality, expertise • Peer review of contribution to product
Typical types of boundary objects			
Pragmatic [31], Standardised forms [3],	Visionary [29] Pragmatic [31], Coincident borders [3]	Syntactic [31], Repositories [3]	Semantic [31], Ideal types [3]

Table 1. Dimensions of solitary and collaborative production of boundary objects (based on Table 1 in [10]).

users did not authenticate their interpretations with the developer of the system. Briers and Chua [29] describe semantic indifferences between the users of the system and a lack of necessary negotiation.

In solitary authorship and HWPP, the *individual to group focus* is on an individual creator while LWPP and emergent authorship anonymises the contribution to an unarticulated entity or the 'crowd'. In SA, the author imposes a candidate BO on communities and consequently, determines the permissible boundary crossings. Specifications and drawings, such as the ones described by Carlile [31] (how a tank and a valve should function)

exemplify an imposed BO that communities typically have to accept. The specifications may be perceived as authored by a customer, but at the same time many specifications are imposed by contextual constraints. In the above example, the fact that the tank and the valve were going to be used in a desert may be seen as the principal originator of the specification (as a DBO) even if the act of creating a document is attributable to a person. In spite of the outspoken focus on a named authority in SA, the enforced nature of BOs is strongest with EA. The emergent nature of authorship denies the existence of a named authority and simultaneously a

party to disagree with. In the case of the tank and valve, it was impossible to change the environmental conditions in a desert. EA may be argued to have a tendency to produce conceptual, or in terms of Briars and Chua [29], visionary BOs. Documents like institutionalised codes, 'best practices' [29] or the netiquette [41] exemplify their nature as emergent ideals that are difficult to dispute because the lack of an explicit author or community of origin.

In LWPP, the BOs are also imposed although instead of an identifiable author, by the system and rules of the participatory infrastructure. In the case of Clickworks, the web application, its design and the rules and alternatives of engagement constrain the emergence of the produced DBO. In tagging systems, the documentation of tagged items emerges from the characteristics and meta model of the tagging system [42]. In contrast, HWPP is explicitly based on the negotiation of membership in the process of creating BOs, the hierarchy of participation and the decisions made about the form and content of the resulting document. Many large open source software projects and their explicitly negotiated understanding of the developed software application [43] (as a DBO of certain practices) are examples an explicit group focus.

The differences in the individual to group focus of the authorship can be related to the distinction of syntactic, semantic and pragmatic boundaries [31], and consequently of BOs capable of crossing them (Table 1). As formal and rules based collective authorship, LWPP emphasises the similarly rules (and syntax) based *syntactic* approach to knowledge. The results of LWPP are often repositories, instances of the Carlile's example of a typical syntactic BO. Clickworks [10] and, for instance, tagging services produce repositories of relatively simple technically uniform data. In contrast, HWPP relies on *pragmatic* knowledge by acknowledging the necessity of negotiation and the significance of the nexus of authorship and audience. As non-consensual approaches, SA and EA are based only indirectly on a single approach of knowing. Depending on the complexity of the imposed BO, the both approaches rely on syntactic and/or *semantic* similarities. Bordering communities need to make reasonably similar interpretations of an imposed code of conduct to make it useful. If the object is relatively simple, a simple syntactic similarity is sufficient, but the more complex the BO is, more semantic overlap is needed.

The mechanisms of *recognition, reputation, and reward* tend to be quantitative in LWPP. Services like Clickworks reward their users by providing quantitative feedback on their activity. Other forms of authorship rely more on qualitative judgments, reputation and reward. In SA, it is possible to conceive that the author may

gain both quantitative and qualitative reward although as an imposed argument, the DBO is intertwined with the mechanisms of recognition, reputation and reward related to the author and her authority. In case of EA, there are no apparent mechanisms for recognition, reputation and reward, because there is no-one to recognise or reward. The reputation of the DBO is based on the social relevance of the viewpoint represented by the BO and its assumed quality in the context of its use. An example of a such BO is a documented method, for example the information systems design approach KOMPASS in the study of Garrety and Badham [30]. They argue that the method functions as an abstract BO that can encourage communication and negotiation between communities because of its externality and reputation as a useful framework.

6. Discussion and conclusions

The central argument of the present study is that the mode of authoring matters in the emergence and the outcomes of BOs. Secondly, we argue that the classification of different approaches of authorship has several analytical benefits that helps to understand BOs and to anticipate their outcomes. Because the present discussion is conceptual rather than empirical, the proposed classification needs to be validated in future comparative studies of the different modes of authorship and their implications on BOs.

Even if the classification of the modes of authorship may seem unproblematic, the hybrid, dual-weight peer production discussed by Haythornthwaite [10] exemplifies its principal limitation. As the earlier discussion on authorship shows, the different forms of authorship are not exclusive and they tend to complement each other. Similarly, the various observable enterprises of producing documents and DBOs often combine elements of different approaches. These negotiations are especially apparent in the different crowdsourcing efforts emerging in the Internet, but equally immanent in collaborative activity outside the digital sphere. Finally, the mode of authorship is dependent on the scale and point of view of the analysis. There are authored DBOs, for instance, the outline of the state of California, that are seldom perceived as attributable to an individual, organisation or a group. Star and Griesemer attribute it (apparently quite correctly) to Joseph Grinnell but it is highly unlikely that the collaborators of the museum considered the outlines of the state of California as his oeuvre. Similarly to the SA of BOs, the definition of EA is also a question of a point of view. Regardless of the emergent nature of the outlines of state of California, the appropriation

of a blank map with state boundaries as a BO can be attributed to Grinnell.

In spite of the complexities of attribution, the proposed approach has a capability to make sense given two fundamental premises. The first premiss of the proposed approach is that the making of a document and the authoring of the same document as a BO are perceived as two separate tasks. The claim might be obvious, but the complexity of the processes of how BOs emerge makes distinguishing the two tasks sometimes an intricate undertaking. As Star [8] stresses, many different types of objects can become BOs under certain circumstances, but an object is not inherently a BO. Personal notes [44] and sketches [26] emerge as a BO only after they cross a boundary between two communities. The author of the BO can be the same individual or group that authored the document, but not necessarily. Notes and reports are often attributed to a group or a corporate entity instead of the individual who wrote them. In the study of Star and Griesemer [3], an outline map of California functioned as a DBO. The specific documents used by Grinnell and amateurs (maps) were undoubtedly attributable to individuals, but the DBO represented by the map was a result of emergent authorship *and* the appropriation of the object by Grinnell in the particular context of the Museum of Vertebrate Zoology. Wikipedia provides another example of the phenomenon. As Haythornthwaite [10] describes, the initial document is a result of LWPP, but the reason why Wikipedia functions as an almost global DBO (and an anonymous webpage probably does not) is the heavy-weight collaborative process that manages the encyclopaedia. As a final example, the development of a SWOT analysis document in MacPherson et al. [45] shows that different authoring strategies can be chained and the authoring of a BO may precede the authoring of the document. The described SWOT analysis was conducted as a continuum of initial interviews, a subsequent round-table review of the preliminary analysis document and its subsequent revision to a final scored summary of strengths, weaknesses, opportunities and threats. The summary was not a result of a single style of authoring, but an apparently conscious combination of LWPP, SA and HWPP. Even if the summary document was a direct result of SA, the role of the document as a DBO is attributable rather to the preceding light-weight and heavy-weight collaborative processes than to the authority of a single author.

Secondly, considering the complexity of authoring processes, it may be argued that authorship is a question of two or more “ends” (rather than a number of distinct categories) similarly to the relation of the two modes of the peer-production of knowledge in the model of Haythornthwaite. Authorship may have characteristics of

several modes. The perception of authorship is therefore primarily a question of *attribution* (discussed by [9]). Individuals and groups have the ultimate power to decide and perceive BOs as emergent or authored differently by individuals, collectives or communities.

Given these postulates, the documentary perspective and the categorisation of DBOs has both theoretical and practical implications. First, a closer analysis of the emergence and attribution of BOs helps to challenge a view of BOs as contextually discrete entities. Similarly to the document theorists writing on documents [11], Star [8] has emphasised that no objects are inherently BOs, but it can be useful to look at certain things as BOs if they function in a boundary negotiating role. The salient aspect of both documents and BOs (and DBOs) is not the object, but the activity. Instead of making a clear distinction between plastic BOs and rougher boundary negotiating artefacts [34], it might be more appropriate to emphasise the significance of a perpetual negotiation incorporated in all, even seemingly established BOs. A classification of the modes of authorship helps to contextualise BOs further as products of complex solitary, emergent and collective processes of making. On the level of individual studies of specific communities, the approach facilitates a move from the local frame of reference to a more general analysis of the specific BOs as products of certain types of social processes with parallels in other contexts. Briers and Chua [29] argue that visionary BOs are characterised by the impossibility to disagree with them. A closer explication of authoring and attribution of visionary BOs might suggest that the visionary nature of certain BOs can be explained by their emergent authorship or a conscious denial of attribution. Similarly, an analysis of the outcomes of the HWPP shows that the resulting BOs tend to be complex and vague in comparison to the formality and relative simplicity of the products of the LWPP across individual contexts of investigation.

Secondly, the categorisation of the modes of authorship can provide a more elaborate picture of the processes of creating and using BOs. The notion of authorship helps to explicate how, when and by whom (agent) objects become BOs in the cyclical model of Star [8], and in the case of DBOs, how authorship is a necessary premiss of the act of documentation. The plasticity [3] of DBOs and their participation in boundary negotiations [34] are closely related to their emergence as authored entities. Similarly to Dutton [46] who sees the principal impact of the Internet in its capability of ‘reconfiguring access’ to information, BOs may be suggested to be ‘reconfiguring access’ and communication between bordering communities. The characteristics that turn documents into BOs is not the information

they contain but the opportunities of communication and information sharing they provide for their adjacent communities. The contents and the final form of a BO is an outcome rather than an instrument. The leverage of opportunities and their capability to catalyse the process of reconfiguration depend on a series of implicit and explicit decisions made by their authors. Similarly to the 'digital choices' (in Dutton's study [46]) made by individuals and groups that affect the outcomes of digital technologies, the evolution of BOs is affected by a series of intentional and non-intentional 'boundary choices' made during the process of their emergence. The conscious or unconscious 'choice' of authoring a BO alone or in a community affects the functioning and the outcomes of a BO similarly to the consequent choices that are dependent on the mode of authorship and opportunities for negotiation.

Thirdly, a closer look at the authoring process can help to understand the premises and outcomes of specific BOs. Carlile [31] has noted that BOs can be used to transform knowledge. To understand the transformations, it is necessary to understand who has created the instrument and how the authorship affects the transformations. The failure of the plant integrated standard cost system in the study of Briers and Chua [29] provides an example of the outcomes of the effect a sub-optimal mode of authorship. It is possible to speculate that the impact of the system may have been different if the system (BO) would have been designed using a collaborative (instead of solitary) approach. A different mode of authoring might have decreased the equivocality of the BO by incorporating more semantic overlap to the object.

In the discussed examples of LWPP, the mode of authorship seems to work as long as the common ground can be described in simple and highly formal terms. A bug-reporting system would cease to function as a DBO if the system would allow too heterogeneous descriptions of perceived bugs and consequently a too ambiguous idea of the nature of 'bug' to emerge. In an emergent authorship of DBOs, the non-attributability of the object is a central aspect that makes it often in some sense visionary and difficult to reject even in relative distant communities. In contrast, the HWPP of DBOs bring communities closer to each other, but at the same time can make the BO easily debatable. An illustrative example of this is the case of scholarly articles and the explicit intention to produce falsifiable conclusions.

Finally, the notions of authorship and attribution have some potential implications to the future research on documents and BOs. I am inclined to argue that a closer look at authorship processes can help to explicate the making of DBOs, but at the same time, it exposes something of the inherent complexity of the evolution of

documents and their resonance in different communities. The differences in the processes of making documents and DBOs open up the complex question of why digital documents and document systems can be seen simultaneously in utopian and dystopian light by neighbouring communities. The attribution of digital documents to individuals, corporate entities, communities and crowds affect the ways how they are perceived and how consequently how they function in the borderlines between different communities. A collaboratively produced DBO of encyclopaedic knowledge like Wikipedia has entirely different capabilities to bridge communities than an imposed commercially authored document infrastructure or an emergent expression of network culture. The capabilities are not inferior. They are merely different and probably more dependent on the attribution of the documents rather than on the actual origins of the BOs.

References

- [1] L. Murphy, "Digital documents in organizational communities of practice: a first look," in *Proceedings of the 34th Annual Hawaii International Conference on System Sciences*, 2001, p. 10 pp., jan. 2001.
- [2] C. Østerlund, "Documents in place: Demarcating places for collaboration in healthcare settings," *Computer Supported Cooperative Work*, vol. 17, no. 2-3, pp. 195–225, 2008.
- [3] S. L. Star and J. R. Griesemer, "Institutional ecology, 'translations' and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39," *Social Studies of Science*, vol. 19, no. 3, pp. 387–420, 1989.
- [4] U. Gal, Y. Yoo, and R. J. Boland, "The dynamics of boundary objects, social infrastructures and social identities," *Sprouts: Working Papers on Information Environments, Systems and Organizations*, vol. 4, no. 4, pp. 193–206, 2004.
- [5] C. Østerlund, "The materiality of communicative practices: the boundaries and objects of an emergency room genre," *Scandinavian Journal of Information Systems*, vol. 20, pp. 7–40, 2008.
- [6] N. W. Lund, "Document theory," *Annual Review of Information Science and Technology*, vol. 43, no. 1, pp. 1–55, 2009.
- [7] R. T. Pédaque, "Document : forme, signe et médium, les re-formulations du numérique," *Archive Ouverte en Sciences de l'Information et de la Communication*, 2003.
- [8] S. L. Star, "Ceci n'est pas un objet-frontière! réflexions sur l'origine d'un concept," *Revue d'anthropologie des connaissances*, vol. 4, no. 1, pp. 18–35, 2010.
- [9] H. Love, *Attributing authorship : an introduction*. Cambridge: Cambridge Univ. Press, 2002.
- [10] C. Haythornthwaite, "Crowds and communities: Light and heavyweight models of peer production," *Hawaii International Conference on System Sciences*, pp. 1–10, 2009.
- [11] S. Briet, *Qu'est-ce que la documentation?* Paris: EDIT, 1951.

- [12] E. H. Wirtén, *No Trespassing: Authorship, Intellectual Property Rights, and the Boundaries of Globalization*. Toronto: University of Toronto Press, 2004.
- [13] C. P. Haviland and J. A. Mullin, *Who owns this text? : plagiarism, authorship, and disciplinary cultures*. Logan, Utah: Utah State University Press, 2009.
- [14] A. Riles, "Introduction," in *Documents : artifacts of modern knowledge* (A. Riles, ed.), pp. 1–38, Ann Arbor: University of Michigan Press, 2006.
- [15] M. Biagioli, "Documents of documents: Scientists' names and scientific claims," in *Documents : artifacts of modern knowledge* (A. Riles, ed.), pp. 127–157, Ann Arbor: University of Michigan Press, 2006.
- [16] J. S. Brown and P. Duguid, "The social life of documents," *First monday*, vol. 1, no. 1, 1996.
- [17] B. Latour, *Science in action: How to follow Scientists and Engineers Through Society*. Cambridge, MA: Harvard University Press, 1987.
- [18] S. E. Fish, *Is there a text in this class?: The authority of interpretive communities*. Cambridge, MA: Harvard University Press, 1980.
- [19] N. W. Lund, "Document, text and medium: concepts, theories and disciplines," *Journal of Documentation*, vol. 66, no. 0022-0418, pp. 734–749, 2010.
- [20] D. M. Levy, *Scrolling forward : making sense of documents in the digital age*. New York: Arcade Publishing, 1 ed., 2001.
- [21] R. Cover, "New media theory: electronic games, democracy and reconfiguring the author–audience relationship," *Social Semiotics*, vol. 14, no. 2, pp. 173–191, 2004.
- [22] J. Antin and C. Cheshire, "Readers are not free-riders: reading as a form of participation on Wikipedia," in *Proceedings of the 2010 ACM conference on Computer supported cooperative work, CSCW '10*, (New York, NY, USA), pp. 127–130, ACM, 2010.
- [23] J. Stiller, *Multiple Authorship and the Myth of Solitary Genius*. Oxford: Oxford University Press, 1991.
- [24] C. Pearce, "Emergent authorship: the next interactive revolution," *Computers & Graphics*, vol. 26, no. 1, pp. 21–29, 2002.
- [25] H. Karsten, K. Lyytinen, M. Hurskainen, and T. Koskelainen, "Crossing boundaries and conscripting participation: representing and integrating knowledge in a paper machinery project," *European Journal of Information Systems*, vol. 10, pp. 89–98, Oct. 2001.
- [26] K. Henderson, "Flexible Sketches and Inflexible Data Bases: Visual Communication, Conscripting Devices, and Boundary Objects in Design Engineering," *Science Technology Human Values*, vol. 16, no. 4, pp. 448–473, 1991.
- [27] F. Harvey and N. Chrisman, "Boundary objects and the social construction of gis technology," *Environment and Planning A*, vol. 30, pp. 1683–1694, 1998.
- [28] J. H. Fujimura, "Crafting science: Standardized packages, boundary objects, and translation," in *Science as practice and culture* (A. Pickering, ed.), pp. 168–211, University of Chicago Press, 1992.
- [29] M. Briers and W. F. Chua, "The role of actor-networks and boundary objects in management accounting change: a field study of an implementation of activity-based costing," *Accounting, Organizations and Society*, vol. 26, no. 3, pp. 237–269, 2001.
- [30] K. Garrety and R. Badham, "The politics of socio-technical intervention: An interactionist view," *Technology Analysis & Strategic Management*, vol. 12, no. 1, pp. 103–118, 2000.
- [31] P. R. Carlile, "A Pragmatic View of Knowledge and Boundaries: Boundary Objects in New Product Development," *Organization Science*, vol. 13, no. 4, pp. 442–455, 2002.
- [32] C. Oesterlund and R. J. Boland, "Document cycles: Knowledge flows in heterogeneous healthcare information system environments," *Hawaii International Conference on System Sciences*, vol. 0, pp. 1–11, 2009.
- [33] C. Lee, "Between chaos and routine: Boundary negotiating artifacts in collaboration," in *ECSCW 2005* (H. Gellersen, K. Schmidt, M. Beaudouin-Lafon, and W. Mackay, eds.), pp. 387–406, Springer Netherlands, 2005.
- [34] C. P. Lee, "Boundary negotiating artifacts: Unbinding the routine of boundary objects and embracing chaos in collaborative work," *Computer Supported Cooperative Work (CSCW)*, vol. 16, pp. 307–339, June 2007.
- [35] M. Douglas, *Purity and danger; an analysis of concepts of pollution and taboo*. New York: Praeger, 1966.
- [36] K. Ruhleder and J. L. King, "Computer support for work across space, time, and social worlds," *Journal of Organizational Computing*, vol. 1, no. 4, pp. 341–355, 1991.
- [37] C. K. Bart and M. Hupfer, "Mission statements in Canadian hospitals," *Journal of Health Organization and Management*, vol. 18, no. 2, pp. 92–110, 2004.
- [38] L. McLeod and B. Doolin, "Documents as mediating artifacts in contemporary is development," *Hawaii International Conference on System Sciences*, vol. 0, pp. 1–10, 2010.
- [39] T. W. Staley, "Keeping philosophy in mind: Shadworth h. hodgson's articulation of the boundaries of philosophy and science," *Journal of the History of Ideas*, vol. 70, no. 2, pp. 289–315, 2009.
- [40] J. Tucker, *Motivating Subjects: Data Sharing in Cancer Research*. PhD thesis, Virginia Polytechnic Institute and State University, Blacksburg, VA, 2009.
- [41] L. Scheuermann and G. Taylor, "Netiquette," *Internet Research*, vol. 7, no. 4, pp. 269–273, 1997.
- [42] L. Garcia-Castro, M. Hepp, and A. Garcia, "Tags4tags: Using tagging to consolidate tags," in *Database and Expert Systems Applications* (S. Bhowmick, J. Küng, and R. Wagner, eds.), vol. 5690 of *Lecture Notes in Computer Science*, pp. 619–628, Berlin, Heidelberg: Springer, 2009.
- [43] Y. Benkler, "Coase's Penguin, or Linux and the Nature of the Firm," *Yale Law Journal*, vol. 112, no. 3, pp. 367–445, 2002.
- [44] M. S. Ackerman and C. A. Hadverson, "Reexamining organizational memory," *Commun. ACM*, vol. 43, pp. 58–64, January 2000.
- [45] A. Macpherson, O. Jones, and H. Oakes, "Mediating artefacts, boundary objects and the social construction of knowledge," in *The First International Conference on Organizational Learning, Knowledge and Capabilities, OLKC 1, 20-22 March 2006, University of Warwick*, (Warwick), University of Warwick, 2006.
- [46] W. Dutton, *Transforming Enterprise: The Economic and Social Implications of Information Technology*, ch. The Internet and Social Transformation, pp. 375–398. Cambridge, MA: MIT Press, 2005.