

An ontology of digital objects in philosophy.

An approach for practical use in research

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1 Introduction and methodology

The digitalization of research enables new scientific insights and methods, especially in the humanities. Nonetheless, electronic book editions, encyclopedias, mobile applications or web sites presenting research projects are not in broad use in academic philosophy. This is contradictory to the large amount of helpful tools facilitating research also bearing new scientific subjects and approaches. A possible solution to this dilemma is the systematization and promotion of these tools in order to improve their accessibility and fully exploit the potential of digitalization for philosophy.¹

Besides the amount of newly-emerged tools, it is important to keep in mind that digitalization in general bears great potential for the humanities. It does not only provide an increased capacity of processing workflows by increasing quantity and speed through machine-driven applications, but it also brings new perspectives to subjects and methods, e.g. via graphic modelling of text mining results. Nonetheless, quantitative methods have been conducted in humanities for a long time (Heidborn 2017), the precision and high capacity of computers provide different possibilities for application going beyond. Using computers, it is possible to profit from the different potentials of human and machine reasoning complementing each other. The reflection on the two different abilities of reasoning – semantic considerations and vagueness handling on one hand contrasted by high accuracy and high performance capacity on the other – could possibly provide the research field with innovative synergies of methods and awareness. Instead of producing more and faster “results”, the depicted collaboration of abilities enables the humanities to reach innovative “insights” (Sperberg-McQueen 2018).

Even so, there are reservations concerning the use of digital tools and methods within the humanities, they are being criticized as biased due to their quantitative approach. In favour of the productive view on digitalization outlined above, the philosopher Johanna Drucker evokes classical reflections of hermeneutics and applies them to the digitalization of science: *Every act of reception* or interpretation by a human researcher or a machine leads to a contextualization and therefore to a change in the original (Drucker 2012: 85–86). Likewise, machine processing entails a transformation of information and syntax. Computer-driven applications are, as Drucker states, a special kind of “reading” and interpretation. Since every adaptation in research will interpret and

¹ Patrick Grim gives some examples of philosophy benefiting from computer modeling within logic, epistemology, philosophy of mind, ethics and others by emphasizing that the use of new technology will not replace the traditional tools (Grim 2004: 346).

The specific benefits philosophy and especially logic can gain from ontology modelling are pointed out by Barry Smith (Smith 2004: 163–164). In return he also points out the benefits computer science gains from dealing with philosophy.

contextualize an argument, machine processing is just one more perspective² on a subject – but a specially-qualified one.

The philosopher Sybille Krämer takes Drucker’s argument similarly in terms of a reflection on the construction of habits in the methodology of the humanities. She also denies the *contrast* of qualitative and quantitative methods by evoking the *interaction* of “close reading” and “distant reading” of texts. The latter, mainly established by Franco Moretti, indicates an approach of “stepping back” to see the text in its context of literary production, genre etc. (Moretti 2013).³ Krämer’s account of synergies of intensive lecture and text mining processes is supported by Mathias Lemke and his concept of “blended reading” in adaption to Moretti (Lemke 2017).⁴ The concept of blended reading aims at a two-step method of computer-driven text mining techniques or distant reading in the first place to identify representative material, followed by a second step, a close and intense analysis of the identified text.

Similar to Sperberg-McQueen, Drucker, Lemke, and Krämer consider the different capacities of text mining and humans to be complementary potentials. They agree that digitalization is more than the improvement of processing as it has a great impact on the development of information tools and certainly offers innovative scientific insights.

Yet, there are many more services and functions supported by digital resources. Nowadays, Digital Humanities extend from repositories of texts and image collections to the representation of research working groups to podcasts, blogs and social media. The broad variety of resources indicate that there are various functions and diverse applications being supported by digital objects. For those reasons, an intelligent use of digitalization for philosophy, enabled by an improved access to digital objects, will without any doubt be productive. The creation of a classification for these objects as a basic infrastructure is a precondition for this goal. The present study will focus on this basis and therefore prepare an ontology of digital information resources in philosophy.

To create an infrastructure in terms of an ontology, we need to cover the “general principles of ontology design” Robert Arp, Barry Smith and Andrew Spear formulated as follows (Arp/Smith/Spear 2015: 43-50): i) realism, ii) perspectivalism, iii) fallibilism, iv) adequatism, v) the principle of reuse, vi) the ontology design process should balance utility and realism, vii) the ontology design process is open-ended, viii) the principle of low-hanging fruit. Currently, the

² As a constructivist, Drucker would disagree to this description as different “perspectives on a common ground”. She argues that there is no shared reality and therefore not several perspectives, but that every reference gives rise to a completely new subject (Drucker 2012: 90).

³ Moretti’s distant-reading approach is opposed to the traditional close examination of a separated text for linguistic observations. For Krämer, close and distant reading has always been part of the toolkit of humanities researchers (Krämer 2016: 7), as already suggested (Heidborn 2017).

⁴ Actually, Lemke’s concept of blended reading aims at social sciences. However, it appears to be reasonable to apply the concept to digital humanities.

fifth principle is the most important. We do not need to create a new design of an ontology for digital information resources – or at least not all of it.

Fortunately, we can rely on the findings of the “Indiana Philosophy Ontology Project” (“InPho”) concerning its classification, as it is accurate regarding the subject indexing created by Indiana University (InPho 2018). InPho has already included the vocabularies of the Stanford Encyclopedia of Philosophy and PhilPapers – two main authorities in the philosophical community – as well as the Internet Encyclopedia of Philosophy and the Hathi Trust/Google Books Collection (InPho 2018). An *ontology of philosophy*, however, is no *ontology of digital objects in philosophy*. As the content of InPho also lacks a formal classification, we can only consider InPho for its depiction of philosophy from the content side.

Similarly, Ludger Jansen introduces two types of ontologies with respect to the content and the technical side (“reference ontology” and “application ontology”), which may help to differentiate the two aspects we need to address when setting up a comprehensive ontology for digital objects in philosophy: “While reference ontologies care about scientific virtues like completeness and precision, application ontologies care about engineering virtues such as efficiency and economic use of resources” (Jansen 2008: 171). Thus, we can easily classify InPho as a “reference ontology”, as using its classification for our needs is a typical application of a reference ontology representing the “state of knowledge of the respective scientific discipline from which they derive” (Jansen 2008: 171). Moreover, it is useful to take up an established elaborated vocabulary in order to gain synergies and avoid repetition of mistakes and unnecessary effort. However, it remains unclear whether the remaining aspects of formal description of InPho can meet the characteristics of “application ontology” outlined above.

Now that the benefits of an upper level ontology that combines both aspects have been made clear, the present study aims to contribute to research by developing a classification for digital objects in philosophy.

In order to develop such an ontology of scientific digital objects in philosophy, it is necessary – following a literature review (1.1) – to survey existing projects reaching for similar goals (see section 1.2) followed by a definition of the actual subject of the classification; i. e. the specification of scientific digital objects (1.3). The following main section (2.2.1) describes the compilation of the empirical register of existing digital objects in use by scientists in the field. Hence, the thesis follows an inductive approach. The demands derived from the compilation and the literature review (i. awareness of different types of media resources, ii. online-offline dualism, iii. different functions and iv. formats of digital objects as well as machine processability) are obliged to be addressed on formal as well as subject grounds (2.2.2). These two dimensions of objects will be conceptualized and interconnected using an upper level ontology (2.2.3). For the purpose of elaborating such a major classification, established metadata sets need to be verified concerning their ability to match the requirements defined previously. Drawing from those investigations, an

ontology will be proposed (2.2.4). Following an application to some examples (2.3.1), the ontology concept is presented to two researchers for evaluation (2.3.2). The study shall conclude with a summary of the findings containing a valuation as well (3).

Critical examination will occur in parallel to the main argumentation. Therefore, a separate “discussion chapter” which would only repeat the considerations stated beforehand, has been omitted.

1.1 Literature review

The following section will provide an overview of some of the literature on the subject matter. The topic set up of this thesis touches several aspects that will be returned to in the course of the research chapters. Several topics such as philosophy of science, ontology building, accompanied by a wide range of research material, will be dealt with.

To situate our research interest within the scope of digital humanities we already consulted Michael Sperberg-McQueen and Johanna Drucker – both international experts – supported by the philosopher Sabine Krämer and data scientist Mathias Lemke, all referring to Franco Moretti’s famous concept of “distant reading” whilst expanding it to a synergetic system of quantitative and qualitative analysis of texts. All these thinkers helped to justify the need for further effort in the field of digitalization of science and especially of the humanities just as the presented study does by structuring digital information resources.

The theoretical background is also strengthened by Luciano Floridi who analyzes the interaction of digitalization and philosophy as well as digitalization and society in numerous publications such as “The forth revolution” and (as the editor) “The Blackwell Guide to the Philosophy of Computing and Information” (Floridi 2004) which became standard literature within the research context of information science and philosophy. Throughout all the subdisciplines of philosophy Patrick Grim (2004), among others, provides a variety of examples for “computational modeling as a philosophical methodology”.

In the following brief look on the philosophy of science, ontologies are considered as *representation of knowledge* (e.g. Gödert 2013: 3) or *representation[s] of data stock* (Stuckenschmidt 2011: 95). Referring to Ludwik Flecks historically qualified concept of *styles of thinking in science* (1980 [1935]), the importance of awareness of the historic and social *context* of a description of knowledge or truth will be stressed. A contemporary update to this thought applied to ontology building is provided by Cristina Pattuelli (2011) who is “modelling a domain ontology for cultural heritage resources” taking a “user-centered approach”.

The mentioned observations reflect the difficulties of defining the subject matter of “objects” (Rettler/Bailey 2017), “digital objects” as well as “data” or “research data” and the associated concept of “research data repositories”. These concepts are going to be discussed in the

examination of the Re3Data initiative. Other than the manual (Re3Data 2016), the publication “Making research data repositories visible. The re3data.org registry“ by the editors of the initiative, Heinz Pampel, Paul Vierkant et al. (2013), is helpful for a categorization as well as the CASRAI Dictionary (2018) and Tina Heidborn (2017) who observe the quantitative handling of research data in humanities during the past centuries while considering the ambiguous data concept in humanities. For the very basic requirements of research data handling – findability, accessibility, interoperability, and reusability (FAIR principles) – functioning as a measure for every research data driven application, we refer to Mark Wilkinson et al. (2016).

In order to design our ontology as a *representation of the scope of digital objects* we acquire our basic knowledge by referring to the basic works of Heiner Stuckenschmidt (2011) as well as Wolfgang Stock and Mechthild Stock (2013). For a theoretical embedding we consult Ludger Jansen, who discusses different types of classifications in ontologies (2008a) as well as top-level-ontology categorization (2008b) and introduces the relevant distinction between “reference ontologies” and “application ontologies”. By her very practical account of ontology building for a specific domain, Pattuelli (2011) enriches the understanding of modeling as a praxis. Gianni Tsakonas and Christos Papatheodorou achieve a similar goal by modeling “an ontological representation of the Digital Library evaluation domain” (2011).

A huge contribution to ontology building, also with regard to Basic formal ontology (BFO), is provided by Barry Smith. Smith’s introduction to BFO, “Building Ontologies with Basic Formal Ontology”, in collaboration with Robert Arp and Andrew Spear (2015), gives detailed advice for adopting BFO. The authors of the manual are part of the group publishing on BFO which makes their introduction even more relevant to us. Further discussion on the “function” category within BFO is performed by Spear, Smith and Werner Ceusters in their publication “Function in Basic Formal Ontology” (2016).

Preceding the ontology building, the present study is going to refer to numerous examples of digital objects for an inductive derivation of requirements and classification terms significant to an accurate ontology description. As there are too many to be presented in detail, they will be discussed within the main argument. In order to elaborate a mapping while benefiting from established metadata schemas, we refer to the Indiana Philosophy Ontology Project (InPho) as reference ontology (InPho 2018). For application ontologies to merge according to the outlined purpose, we discuss Dublin Core, DataCite and Re3Data in detail (Dublin Core 2013; DataCite 2018; Re3Data 2016) and MARC21 and DOI (DNB 2018; DOI 2017) on a basic level.

A guide to a practical application of our ontology will consist of the components of the specialized information service (FID) for history research “historicum.net” (historicum.net 2018), the literature portal “Philosopher’s Index” and the recently funded specialized information service for philosophy (Glaser 2015; Burmeister-Neuls 2018). For a better understanding of research politics and the shift from a special collections program to the specialized information service

program of the DFG we refer to the DFG declaration (DFG 2015) and to the WEBIS service of the Hamburg university library (SUB) informing on funding guidelines (WEB 2018). The argument continues from this aspect and focuses on the applications in the following.

1.2 Existing projects reaching for similar goals – A look at current practices

In order to create an adequate ontology, a glance at already-existing web platforms will contribute to visualizing the potentials and limits of applications based on an ontology for digital information resources in philosophy. Two examples seem to be interesting for our purpose: i) “*historicum.net*” as a comparable implementation already realized in Germany for the field of history research; ii) on an international level, “*Philosophers’ Index*” – a bibliography of philosophical literature. As a third step in this section (iii), a possible application for the targeted ontology within the philosophy FID at Cologne University will be suggested.

1.2.1 *Historicum.net*. Virtual library and Specialized Information Services

When pursuing the goal of a classification of digital objects in philosophy, we can learn a lot from existing projects and web portals in the digital humanities. Since philosophy deals with many historic sources and texts by ancient philosophers, medieval scholastics and early modern studies including their own history of tradition or translation, the requirements for a historic metadata schema or classification structure seems to be related to those of our endeavor. In the German research context, *historicum.net* is a successful platform providing the historic research community with facts, sources, literature and supportive material.

There has been a shift in the funding of digital media in Germany due to the introduction of German Research Association’s (Deutsche Forschungsgemeinschaft, DFG) specialized information services program (Fachinformationsdienste, FID). The FID program supports the supply of research requirements i. e. scientific literature and information including “site-independent access” via research portals or search engines (WEBIS 2018). Digital tools are expected to be developed in accordance to the special needs of a research field (DFG 2015). The FIDs replace the special collections program (Sondersammelgebiete, SSG) and their aim to warrant an extensive collection of literature implying an archive function. In addition, the SSG had been engaged in virtual libraries (Virtuelle Fachbibliotheken) for each research subject. In opposition to this, the FIDs promote an approach of relevance in accordance to the digital demands of the 21th century.

Since FIDs have been implemented in 2014, several FIDs emerged in the field of the humanities, providing search portals or digital bibliographies for research material. Based on the web portal of the virtual library of special collections, a revisited edition of *historicum.net* was released in early 2018. At present, the former version and the revised beta version

beta.historicum.net are operating in parallel until all functions will be integrated under the label historicum.net (historicum.net 2018).

beta.historicum.net defines four main sections referring to the domains of the history FID operated by the Munich Bavarian State Library (Bayerische Staatsbibliothek): i) research in libraries and data sources, ii) services provided for researchers, iii) thematic bibliographies compiling relevant information and iv) digital offers for specific historic domains like the history of technology (beta.historicum.net 2018).

As the self-description indicates, the fourth domain seems to pursue a target similar to the services that could be realized by the planned ontology for digital objects in philosophy: The section “Disziplinen” describes its use as follows: “*Disziplinen* fächert die digitalen Angebote zu Epochen- und Sachdisziplinen (z.B. Technikgeschichte) auf” (beta.historicum.net 2018; my highlighting). Browsing this section, a range of various material can be discovered, as is to be expected from the description. At this stage in Summer 2018, the service offers a wide range of introducing text, bibliographies, timelines and link collections. The paragraphs function as a kind of online introductory handbook or manual rather than an overview on available digital tools as advertised in the description. Nevertheless, an advantage from this form of introductory web platform can be seen in the possibility of easily updating the information provided.

For more information on the planned content and approach of historicum.net, Bayerische Staatsbibliothek was repeatedly contacted by e-mail – though without reply containing the requested information.⁵ However, one can benefit from the review of historicum.net by shaping the idea of the purpose of the attempted project, which aims for a different objective. Its intent is not to offer domain-specific content but *domain specific distributors for content*. The planned ontology will, instead, function as a meta-supplier for information or an aggregator rather than as the supplier or creator of the content itself.

1.2.2 An example for an international platform: Philosopher’s Index

The biggest bibliography in the area of philosophy is the Philosopher’s Index. Introduced in 1967, it is provided by the Philosopher’s Information Center in Bowling Green, Ohio – a non-profit organization “dedicated to serving the global philosophical community” (Philosopher’s Index 2017).

Bringing together the content of journals (print and e-journals), books (print and e-books), encyclopedias, dictionaries, paper collections and book-review databases, the Philosopher’s Index contains 650 000 records covering a broad range of subject areas and publications from 1902 to the present (Philosopher’s Index 2017). A team of philosophically-trained scientists index each

⁵ At the final stage of the thesis an e-mail was received. Unfortunately, the tardy offer for an information exchange due to the revisiting process of historicum.net was too late for being pursued.

item without machine-driven indexing, actually increasing the quality of description. The thesaurus used contains 18 000 subject headings (Philosopher's Index 2017). According to own declaration, an average of six keywords is allocated to each record. For metaphysics, philosophy of science, bioethics as well as (forthcoming) philosophy of politics and ethics, the web site offers network graphs. While abstracts and record information are freely available, the access to many full texts is only possible through a license from publishers such as EBSCO, ProQuest and others. Correspondingly, the ontology data is not published openly but proprietarily⁶, which is why – as in the case of historicum.net – the present research project cannot benefit from Philosopher's Index data by implementing the network graphs or ontology data. On the contrary, PhilPapers, Stanford Encyclopedia and others projects indexing under open science standards for the benefit of research help, advance science.

Philosopher's Index is a classic discovery system bringing together different sources of textual data for scholarly research. In contrast, the service based on the projected ontology will present digital resources not limited to literature in print and digital formats. It goes beyond the focus on journals and books by including other forms of information such as comments, podcasts, videos, interviews, blog articles and, therefore, a kind of information which could be classified as *digital grey literature*.⁷

Though Philosopher's Index will be referred to as *one of those digital objects* referred to in the present project, the focus is in comparison tremendously enlarged. It does not serve the purpose of discerning the relevant literature and giving access to it if possible. While dealing with the same domain, the objective of Philosopher's Index is quite different to that of the intended ontology for digital objects in philosophy.

1.2.3 “Fachinformationsdienst Philosophie” in Cologne as a potential example for application

From the aforementioned examples we can deduce some characteristics inherent to the present project by identifying distinctions. In contrast to historicum.net and Philosopher's Index, the present project is able to clearly determine the content. The focus is neither on the supply of literature as provided by Philosopher's Index nor on the offer of introductory material to subject matters as in historicum.net. Despite the different alignment in function of the latter, the history FID and the ontology targeted in the present study, historicum.net may function as a foundation for a digital library of philosophical information resources.

In early 2018 the Cologne University and City Library (Universitäts und Stadtbibliothek, USB) and the Cologne Center for e-humanities (CCeH) have been entrusted by the DFG with building

⁶ Nevertheless, we contacted the editors via e-mail for information on the metadataset – though without receiving any reply.

⁷ In our use case, presented in the following section, the Cologne University library already takes care of *printed grey literature*.

a philosophy FID for the German research community. This Cologne philosophy project is hoped to be the “lighthouse for research in philosophy” (Burmeister-Neuls 2018, my translation). Since the mission of an FID is site-independent access to literature and information resources, a digital infrastructure is supposed to be an integral part. Despite this, an investigation among researchers working in the field of philosophy and promotion by the German Society for Philosophy (Deutsche Gesellschaft für Philosophie, DGPhil) and the German Society for Ancient Philosophy (Gesellschaft für Analytische Philosophie, GAP), only a moderate interest in digital infrastructure became apparent (Glaser 2015: 2).

Furthermore, the investigation showed a clear need for a search portal in terms of a discovery system in order to enable centralized research in different databases (Glaser 2015). Along with the supply of literature, one part of the relevant content for research is the depiction of digital objects. The essential element of the philosophy FID will therefore be an ontology for indexing digital objects collected within the service. The target ontology worked out in this thesis is a basic component for reaching this goal.

1.3 On digital objects in scientific philosophy.

The term “digital object“ refers to a wide-ranging concept. For the moment, it can be qualified as a digital thing and therefore as a thing that can be retrieved from the internet or that can be displayed by electronic media. Starting from a brief outline of a philosophical understanding of the term “object” as the essential basis, the following reconstruction will approach the working concept by introducing the aspects of “digital”, “philosophical” and scientific”.

For a project dealing with philosophy, it is quite useful to reach at least a loose awareness of the term as it is used within the field of research and its community. Although an exemplification by defining a term will – in philosophy – always remain just a single argument in the debate, it is an important one. The Stanford Encyclopedia defines the main part of the expression – “object” – as follows:

One might well wonder—is there a category under which *every thing* falls? Offering an informative account of such a category is no easy task. For nothing would distinguish things that fall under it from those that don’t—there being, after all, none of the latter. It seems hard, then, to say much about any fully general category; and it would appear to do no carving or categorizing or dividing at all. Nonetheless there are candidates for such a fully general office, including thing, being, entity, item, existent, and—especially—object. (Rettler/Bailey 2017; highlighted in the original)

In this definition, “object” appears as a fundamental category. Every existing, identifiable or nameable thing can be referred to as an “object”. However, this extensive conceptual rapprochement is much too broad for a working concept since it includes *everything carrying a name*.

Nevertheless, the broad definition meets the precondition of metadata as Stock and Stock define it: “[M]etadata are standardized data about documentary reference *units* [...]. Metadata stand in *relation* to one another and provide, when combined correspondingly [...] knowledge representation” (Stock/Stock 2013: 569; my highlighting). Following this definition every existing metadata refer to an object. To put it the other way round, the object is the very basic item of description using metadata. However, the object is more than the identity of an objectified unity. The identified object always *refers to something beyond itself*. The object, like the metadata, stands in relation to other objects and *gains its value from this interconnection*.

Fortunately, there are more attributes describing the topic of digital objects. Approaching the concept of an object qualified as “digital”, the Digital Object Identifier DOI can be considered as a second rapprochement to the topic. Since 2000, the DOI is provided for permanent and unambiguous retrieval of digital objects as an international ISO-standard. Unambiguous allocation is relevant because of constantly changing URLs which make documented localizations point to a dead end.⁸ Determined by a minimal set of properties, the DOI refers to a bunch of entities:⁹ for instance monographs, individual articles, videos, research data or images. Conversely, dynamic objects such as web pages or discussion blogs do *not* receive a DOI due to their fluctuating character which makes citation impossible if they do not fulfil the condition of a persistent landing page that is obligatory for a DOI.

In respect to the purpose of creating a *persistent* identifier for the initiative, the DOI cannot offer a satisfying definition of digital objects. These can be formulated in a wider scope including web sites such as successive editions of an author’s work. Furthermore, the corpora of the several lemmata of an encyclopedia have to fit our concept of digital objects; just like the webpage of a research project presents the research work and a group of fellows. However, the DOI gives a first practical notion of what digital objects can refer to even though DOI is too limited for the projected goal.

Returning to the *thing in digital format*, digital objects may be characterized by their content as providers of information or *research data* or digital repositories of information. The specific content – such as text editions, schedules, bibliographies, calls for papers, announcements etc. – provided by digital objects creates a benefit for researchers as well as shows the relevance of the attempted classification. The CASRAI standard dictionary of research administration information provides a definition of the term “data” that reveals an extremely broad understanding of research data, which actually appears to be the central capacity of the present subject matter since it generates the value for researchers:

⁸ It would be interesting to know whether the dissemination of DOI actually impedes the expansion of the deep web.

⁹ Among others, the DOI property “character” is proposed to be filled with the values “music, language, image, other“ (DOI 2017). It is obvious that this list suggests the senses addressed by certain digital objects rather than specific media types.

Data that are used as primary sources to support technical or scientific enquiry, research, scholarship, or artistic activity, and that are used as evidence in the research process and/or are commonly accepted in the research community as necessary to validate research findings and results. All other digital and non-digital content have the potential of becoming research data. (Research Data, in: CASRAI Dictionary 2015; my highlighting)

In terms of the wide definition of research information provided by digital objects, either functioning as information repositories, the observed role as literature suppliers or providers of introductory material performed by the presented examples of Philosopher's Index and historicum.net, the pursued ontology all the more appears to be a kind of *aggregator* or *meta-supplier* of digital objects providing information or research data.

Yet there are two more criteria for the present concept of digital objects by which the understanding is shaped that digital objects should be “philosophical” as well as “scientific” in that academic terms. Both qualities are quite vague. It is not easy to distinguish popular philosophy from “true philosophy” as “truth seeking” by “friends of wisdom” what – as many will already know – is the original meaning of the word “philosophers”. At first glance, participation in academic circles could be seen as a criterion of being “scientific”. It is true that the history of people and ideas in philosophy is evidence that neither does belonging to established academia qualify excellence nor does failure in academic system prove non-excellence – as the biographies of Socrates, Spinoza, Benjamin, many unknown female philosophers and others show. Nevertheless: the recognition by people – that might reflect in academic success – is certainly an indication for relevance to people and philosophical ideas.

The rise of different media types of information resources also increases the difficulty. A web blog is, without question, a digital object. But could a blog be qualified as scientific? There is always a kind of periphery of scientific debates in popular reception, as e. g. Ludwik Fleck pointed out in his concept of co-thinking collectives. Such a “Denkkollektiv” consists of an inner and an outer circle of research debate which influence each other simultaneously. This consideration weighs even stronger as researchers depend on public awareness. Thomas Kuhn adopted this idea and integrated it in his concept of scientific revolutions. For the attempted classification, this means that deciding on a scope of addressed recipients leads to a different granularity of the elaborated vocabulary as Christina Pattuelli states in the sense of Fleck (Pattuelli 2011: 336).

The task for modelling “philosophic” items deals with similar difficulties. Like other humanities, philosophy is not clearly distinguished from related activities. As traditional arguments and their genesis in debates throughout history are an important subject in philosophical work and philosophical debates are carried on within a historic context as well as across centuries or are resumed after long periods of time, philosophy benefits from a sideways glance on the socio-economic conditions in which debates occur (Seidlmayer 2017: 157). Therefore, history, literary studies, sociology, political science and others can guide philosophical arguments as well.

To summarize these thoughts on the vagueness of scientific relevance by taking into consideration the specific characteristics of philosophy: Since digital representations of knowledge are “complex sociotechnical systems” in general (Tsakonias/Papatheodorou 2011), a compilation of digital objects in philosophy can never claim to be complete. Likewise, an ontology design process is always open-ended (Arp/Smith/Spear 2015: 48–49). However, the focus on an actual use case and the relevance for people that are interested in the subject may generate a good compilation that will nevertheless not be complete. This applies even more in the light of future development of digital tools and materials.

Accordingly, the present endeavor needs to be grounded by empirical data provided by suggestions of experts. A domain ontology is more effective if it integrates the demands of the prospective community (Pattueli 2011: 316). The promoted collection of digital objects used in the preparation and proposal of an ontology and the following evaluation will therefore need to be based on at least a small amount of case studies planned to be enlarged in practical use. The inductive process is a result of the previous arguments on the representative character of the compilation that refers to a vivid ontology, open to new cases and properties.

1.4 Results

Reflecting on the subject matter as well as on the context our endeavor is located in, it was possible to gain an impression of potential applications as well as to get an idea of the actual “digital object” item about to be classified. By examining two portal projects performing digital humanities on the German and international level – *historicum.net* and *Philosopher’s Index* –, it was possible to divert the practical orientation away from the supply of literature and science manuals towards an approach of serving the research community by merging research data providers into a broad understanding of “research data”. This service portal might potentially be situated within philosophy FID.

Furthermore, it has been established that neither the concept of digital objects nor the ontology aiming for an accurate description can ever be complete due to the ambiguity of the matter of scientific philosophy itself and the rapidity of the transformation of user expectations evoked by new technologies. On the account of methodology Pattueli’s approach of an early inclusion of the target user group has been stressed. Likewise the principle of reuse of already achieved results and the ongoing openness of ontologies introduced by Arp, Smith and Spear who emphasize the open character of these *representations of knowledge*.

The following section will be concerned with the examination of empirical items as well as pre-existing present metadata sets worth considering for the classification. Finally, a modelling solution is presented.

2 Ontology building and evaluation

In order to build the ontology according to the outlined purposes a collection of digital objects will be compiled to get a more concrete impression of the subject (2.1). In the following, the mapping of a metadata set will be conducted to reach an accurate description of the depicted objects (2.2). Finally, the proposed schema is evaluated (2.3).

2.1 Registering existing digital objects and inductively establishing classification requirements

To reach an accurate impression of the wide range of possible objects outlined above as a concept, an empirical list of existing objects has been compiled. The compilation is based on expert information, e.g. personal conversation with the author, and on a survey carried out in preparation for a philosophy FID at Cologne University. This was enhanced by searching the internet for representative kinds of digital objects using search queries such as “philosophy AND blog” or “philosophy AND conference”, and referring to special databases recording funded research projects such as the German Project Information System GEPRIS by DFG (GEPRIS 2018). This approach is in accordance with the basic assumption Pattuelli states for the development of an ontology: the integration of end users requirements at an early stage for a more appropriate result (Pattuelli 2011: 316:338).

Other than the basic demands for findability, accessibility, interoperability and reusability, stated in the F.A.I.R. principles, that need to be realized by a well-formed data schema (Wilkinson et al. 2016), there is a fundamental decision to be made when preparing a description of the empirical items: What should be the preferred starting point for processing? Is there a reason to prefer formal indexing aspects above content aspects, or vice versa? Arp, Smith, Spear state that an appropriate ontology should make maximal use of a reference ontology and take it as its starting point (Arp/Smith/Spear 2015: 55). As stated before, we can refer to InPho for a subject classification. Thus, this project will focus on the definition of formal requirements derived from the characteristics of an actual compilation of digital objects.

Hence the focus lies on formal category-building, although, the future service based on the ontology will certainly offer both formal and subject access for browsing. A second step will bring together both necessary aspects of our ontology: the reference ontology and the application ontology.

The digital objects survey list outlined below can be grouped into several kinds. The main part includes web sites of projects containing entire text editions (type 1) as well as web sites representing the work of an individual research group (type 2). The third type comprises blogs (type 3) and the fourth podcasts (type 4). Moreover, a fifth type can be conceived for research institutions such as clusters of excellence, research centers and graduate schools (type 5). Mobile

applications can be considered as a sixth type of digital objects (type 6). These types of media represent the basic content-type expectations and search habits of users.

Social network media or internal discussion groups such as closed chat groups in messenger services like WhatsApp, Telegram etc. will be left out. This also applies to mailing lists, Twitter hashtags and accounts or Facebook groups and profiles due to their primary focus on networking. Furthermore, those objects are located in the grey area between public and private communications, science and hobbyism, due to their immediate and dynamic character. Those special cases of digital objects need to be addressed in a future expansion of the ontology due the space limitations of the present paper.

On the basis of those types a prototype list of actual objects can be provided:

A preliminary compilation of random digital objects in philosophy		
provisional types	provisional compilation	
Type 1: Repositories:		
Type 1a: Text edition (scholarly literature):	Edition des Briefwechsels Wilhelm Diltheys	http://www.ruhr-uni-bochum.de/philosophy/dilthey/dilthey_brief.html.de
	Digital Averroes Research Environment (D.A.R.E.)	http://dare.uni-koeln.de/
	The “Schedula diverdarum atrium” – a digital critical Edition	http://schedula.uni-koeln.de/index.shtml
	Die Schule von Salamanca	http://www.salamanca.adwmainz.de/informationen.html
	Perseus Digital Library	http://www.perseus.tufts.edu/hopper/
	Thesaurus Linguae Graecae (TLG)	http://www.tlg.uci.edu/index.prev.php
	Marx-Engels-Gesamtausgabe (MEGA)	http://mega.bbaw.de/
	Thesaurus indogermanischer Sprach- und Textmaterialien (TITUS)	http://titus.uni-frankfurt.de/indexd.htm?/index.htm#Etable
Type 1b: Text editions (journals/books):	E-Periodica	https://www.e-periodica.ch/
	Zeno.org Meine Bibliothek	http://www.zeno.org
	EDissPlus	https://www2.hu-berlin.de/edissplus/
	Projekt Gutenberg	https://www.gutenberg.org/
	eDoc-Server	https://edoc.hu-berlin.de/
	European Commission Open Research Publishing Platform (under construction)	https://ec.europa.eu/research/openscience/index.cfm
Type 1c: Research data/art/images/sound/video:	Frankfurt Digitale Sammlungen	https://sammlungen.ub.uni-frankfurt.de/
	Edition Topoi	https://edition-topoi.org/
	Europeana	https://www.europeana.eu/portal/de
	L.I.S.A. Wissenschaftsportal der Gerda Henkel Stiftung	https://lisa.gerda-henkel-stiftung.de/
	Thesaurus indogermanischer Sprach- und Textmaterialien (TITUS)	http://titus.uni-frankfurt.de/indexd.htm?/index.htm#Etable
Type 1d: factual databases/reference books/bibliographies/teaching material:	Stanford Encyclopedia	https://plato.stanford.edu/
	Philosopher's Index	https://philindex.org/
	L'Année Philologique	http://www.annee-philologique.com/
	Thesaurus indogermanischer Sprach- und Textmaterialien (TITUS)	http://titus.uni-frankfurt.de/indexd.htm?/index.htm#Etable
	Routledge Encyclopedia of Philosophy	https://www.rep.routledge.com/
Type 2: Project documentation:		
Type 2a: Web site presenting a research group or project:	Die Sprache der Dinge. Philosophie und Kulturwissenschaften im deutsch-russischen Ideentransfer der 1920er Jahre	https://dbs-lin.ruhr-uni-bochum.de/gachn/
	Ontology After Quine: Fictionalism and Fundamentality	https://carvingnature.net/
	Ratio religionis: Religiöse Philosophie und philosophische Religion in der frühen Kaiserzeit	http://www.ratioreligionis.uni-goettingen.de/ (not online anymore)
	Memophi	https://www.memophi.uni-freiburg.de/
	Tiefe Meinungsverschiedenheiten	http://tiefemeinungsverschiedenheiten.de/
	Vernünftiger Umgang mit unscharfen Grenzen	http://www.unscharfe-grenzen.de/www.unscharfe-grenzen.de/index.html

	Epistemologie von Gedankenexperimenten und kontrafaktischen Konditionalen	https://www.philosophie.hu-berlin.de/de/lehrbereiche/idealismus/forschung/Epistemologie
	Kant-Lexikon	https://www.uni-frankfurt.de/43443953/Kant-Lexikon
	Interaktionistischer Konstruktivismus	http://konstruktivismus.uni-koeln.de/start.html
Type 2b: Conference documentation:	philevents. Conferences, CFPs, and seminars in philosophy	https://philevents.org/
	Copenhagen Summer School in Phenomenology and Philosophy of Mind	https://cfs.ku.dk/summer-school-2018/
	Festival der Philosophie	https://www.philosophiefestival.com/
Type 3: Dynamic web sites:		
Type 3a: Collaborative web space:	An inquiry into modes of existence (AIME)	http://modesofexistence.org/
Type 3b: Blogs:	Theorieblog	https://www.theorieblog.de/
	Philosophieblog	http://philosophieblog.de/
	Philosophische Schnipsel. Notizen, Essays & Reflexionen zu Kultur, Medien, Literatur und Gegenwartsphilosophie	http://oxnzeam.de/
	Digitalität in den Geisteswissenschaften	http://digitalitaet-geisteswissenschaften.de/
Type 4: Podcasts:		
Type 4: Podcasts:	Philosophisches Radio. Denn Denken hat was (WDR5)	https://www1.wdr.de/radio/wdr5/sendungen/philosophisches-radio/uebersicht-das-philosophische-radio100.html
	Philosophy Podcast (BBC Radio 4)	https://www.bbc.co.uk/programmes/p01f0vzt/episodes/downloads
	TED Talk. Ideas worth spreading	https://www.ted.com/
Type 5: Research institutions and centers:		
Type 5: Research institutions and centers:	Die Herausbildung Normativer Ordnungen/The formation of normative orders (Cluster of excellence)	http://www.normativeorders.net/de/
	Topoi – Die Formation und Transformation von Raum und Wissen in den antiken Kulturen (Cluster of excellence)	https://www.topoi.org/
	Berlin School of Mind and Brain (graduate school)	http://www.mind-and-brain.de/home/
	Religiöse Kulturen im Europa des 19. und 20. Jahrhunderts (graduate school)	http://www.igk-religioese-kulturen.uni-muenchen.de/index.html
	Episteme in Bewegung – Wissenstransfer von der Alten Welt bis in die Frühe Neuzeit (Sonderforschungsbereich)	http://www.sfb-episteme.de/
	Friedrich Schlegel Graduate School of Literary Studies (graduate school)	http://www.geisteswissenschaften.fu-berlin.de/en/friedrichschlegel/index.html
	Dewey Center	http://www.hf.uni-koeln.de/dewey/
	Hegel Forschungsstelle	http://www.philosophie.uni-muenchen.de/lehreinheiten/philosophie_2/forschung/hegel/index.html
	Saisir l'Europe/Europa als Herausforderung (German-French research network)	http://www.saisirleurope.eu/
Type 6: mobile applications:		
Type 6: mobile applications:	TED	https://play.google.com/store/apps/details?id=com.ted.android
	Philosophy Quotes	https://play.google.com/store/apps/details?id=com.mbwasi.philosophia&utm_campaign=free-traffic&utm_source=solutions-softronic-com&utm_medium=referral
	Oxford Dictionary of Philosophy	https://play.google.com/store/apps/details?id=com.mobisystems.msdict.embedded.wireless.oxford.oxfordphilosophy https://itunes.apple.com/us/app/oxford-philosophy/id919089407?mt=8

The attempt to classify a random number of digital objects reveals the difficulties of the provisional listed types and patterns. Many of the items can be classified in more than one category, like the “Thesaurus of Indo-European language and text materials” (TITUS) which provides, among others, dictionaries, text editions along with teaching materials and sound examples. While the supply of facts and texts can be classed as “data edition”, the teaching

materials could be filed under “collaboration”. Therefore, the attempt for allocation requires an improved and more accurate account of categories.

This quite rough pattern of digital media resources should however not be dismissed since it refers to a basic category or research interest. Yet a representation of the media type is only the first requirement the projected ontology is supposed to fulfill. There are some more. Apart from i) the *search interest* in awareness of the media types of digital objects, there are at least three more requirements that can be determined as conditions from the compilation for a metadata schema: ii) an *offline-online dualism* of many digital information resources, iii) the *functionality* or *disposition* of the content promoted by digital objects. This aspect is highly related to the first mapping of media types, primarily due to search interests concerning a special format or media. A final aspect appears to be iv) *machine processability* despite a high diversity of formats. This leads to the following requirements:

ii) A fundamental impact on the shape of the research landscape as well as the emergence of digital objects caused by political decisions made by funding organizations and political decision-makers. Those dependencies are supposed to be made transparent in the data describing an item. Dealing with the double structure of an offline project and the online objects representing the offline work, the listed objects are frequently affected by the conditions of the project or initiative in relation to which they have been created. In times of increasing digitalization, the creation of a digital object is a precondition for funding. Frequently, the mandatory character can be observed – when a digital presentation obviously only serves as a stopgap.

As in the case of a research project documenting its activities on a web site, the digital presentation and the actual project are subject to particular conditions of the offline instance. These conditions may concern the beginning and duration (frequently web sites last longer than the related project; this can be observed at a research project at HU Berlin and University Freiburg “Vernünftiger Umgang mit unscharfen Grenzen” (Unscharfe Grenzen 2013)) or may cover only parts of the research content or project activities. Online representations and the offline project are *not necessarily congruent* or developing simultaneously.

A similar aspect of the dualism of online and offline instances can be observed at the “Metametaphysics” project (Metametaphysics 2013). The online presentation is quite confused and confusing. Internal schedules including references to first names are presented instead of expected information on the project interest. With respect to the purpose of the web presence remaining unclear to the external visitor, this underlines the need to be aware of the external and internal dimensions of a project on the publishing side as well. Both dimensions of the online-offline dualism are highly connected to the particular function of a digital object, as discussed below.

The depicted online-offline dualism may not apply to every registered object specifically made for digital use – such as blogs, podcasts or digital editions – which form an exceptional cluster in

the prospective schema. However, the dualism still is an important requirement that should be addressed by a metadata schema. Therefore, the vocabulary that is to be created in this study should be sensitive to the dual capacity of many digital objects.

In consequence of the considerations above, an adequate description schema will need to distinguish between the terms referring to the offline tier of a project and its online representation. The offline classification will need to take into account title, funding and the hosting institution, duration, related researchers, in particular the principal investigator, and last but very important, the content classification. Referring InPho to subject ontology as stated above.

Many more aspects may be described. Anyhow, the focus here is primarily on classifying the digital level spawned by the offline entity. In this context, it is important to keep in mind that online entities change over time. We need to store a persistent location identifier along with the URL (a potential way to achieve this could be the Wayback Machine URL, for example the Internet Archive (Internet Archive 2018)). Moreover, the frontend language(s) is (or are) important to note. Additionally, the function of a digital object, or the disposition for using it, should be classified properly. Assumptions on appropriate approaches to this will be discussed in the following section.

iii) As we already noticed: The purposes of digital objects vary considerably. Our register shows objectives including the representation of a certain project, the intention to supply research data and facts for further research to the public or other scientists, and invitations to discussion. The latter can be seen in blogs, call-in podcasts, and, most pronounced, in collaborative writing platforms as social philosopher Bruno Latour's "Inquiry into modes of existence" (AIME, Modes of Existence 2013). These diverse functions reflect the interests of people doing philosophy that can be clustered into three main patterns: *presentation*, *information* and *collaboration*.

Networking as a fourth interest had to be skipped in this context in order to allow for a more detailed discussion of the other aspects with respect to the limited scope of this thesis. Nevertheless, examples such as Academia.edu, Google Scholar, ResearchGate or even Facebook show that there is a great amount of highly adopted networking tools.

The brief list above implicitly models the different functions of digital objects and, therefore, offers some insight into different application interests. Type 1 involving repositories of different kinds addresses the need for information. The interest for presentation is covered by type 2, type 5 and the listed web sites documenting the activities of a project or institution while types 3, 4 and 6 refer to objects (as blogs, interactive web sites, podcasts and mobile apps) at least potentially including collaboration tools. According to Andrei Broder and Dirk Lewandowski, the three different interests for research within a search portal for digital objects can be considered three kinds of "information needs" (Broder 2002). Thus information needs expressed in web searches

can be classified as “navigational”, “informational”, and “transactional” information needs (Broder 2002. 5).¹⁰

From these considerations we can infer the demand for certain terms that should be part of a metadata schema. The attributes for function should include (ii.i) documentation, (ii.ii) repository and (ii.iii) collaboration, containing the following subcategories: (ii.i) documentation: project description, working group description, event schedule, list of publications, calls for papers, job announcements; (ii.ii) repository: factual databases (encyclopedia, dictionary, bibliography) and source editions (text editions, text translations, digital surrogates (manuscripts, prints, art)). There should also be a remark on the mode of access (free due to open access or licensed) in the repository category. It might be even more appropriate to situate the remarks on access and rights on a higher level in the area of the online level. (ii.iii) The third function, collaboration, should include the following sub-attributes: annotation, networking and comments. Although we announced to skip dedicated networking tools, it is reasonable to register networking facilities since they are often a minor component among others.

(iv) A fourth requirement derives from the tremendous quantity of digital objects – a circumstance related to the diversity of formats and functions of digital objects. In the survey we can find quite different representations of digital objects. Other than the different functions we just observed, this diversity concerns the item formats. Frequently, repositories make digitized handwritings and prints available alongside a critical text edition and translation – such as the “Durandus Project” of Thomas Institut at Cologne University (Durandus 2018), the edition of Wilhelm Dilthey’s correspondence by Dilthey Forschungsstelle at Ruhr University Bochum, or the Marx-Engels-Gesamtausgabe MEGA, published by Berlin-Brandenburgische Akademie der Wissenschaften. Instead, on the Gerda-Henkel foundation’s L.I.S.A. portal, we find lots of videos, promoting interviews or conference documentations. Furthermore, the European digitalization platform Europeana presents images as photos or digitized artwork, while Edition Topoi of the cluster of excellence Topoi provides, among other items, interactive displays of buildings or digitized findings. The list can be continued with podcasts dealing with audio data, mobile applications, or project web sites promoting a conference schedule or list of literature in formats compatible with reference management systems or calendar applications. Thus, the second requirement deriving from the inventories demands a broad adaptive capacity of the metadata schema to support different and varying data formats.

¹⁰ Unfortunately Broder picks quite misleading terms for his observations. I consider the term „transactional“ as deceptive, since it suggests a purchase purpose that is no condition for the transaction-driven need for information as described by Broder and Lewandowski (Lewandowski 2015:70). Instead, “interactional” seems to be rather more appropriate. By contrast to the too-narrow meaning of “transactional” the expression “informational” need for information appears to be too broad, as every need for information is informational per definitionem. The term “factual” appears to be more adequate.

As a result, one last requirement can be deduced so far: it is the demand for machine compatibility regardless of the diversity of formats. Focusing on an appropriate handling of research data in advance the publishers of the F.A.I.R. principles emphasize the increasing role of machines in data handling in contrast to humans (Wilkinson et al. 2016). Optimization for machines handling the data is one more requirement the metadata schema for digital objects has to fulfill.

Above observations can be summarized as a first result, in the following schema of attributes to describe digital objects in scientific philosophy. Further steps will be necessary to reflect and refine the terms by taking existing schemas into consideration. The specified requirements and the connected attributes will be compared to present metadata standards and are subject to extension at a later time. For now, the required description can be realized by the following set of terms .

As a working designation, the namespace “dopho” for “digital objects in philosophy ontology” will be used.

Overview on dopho categories for the description of digital objects in philosophy					
DigitalObject	DigitalObjectType				
	Title				
	ThematicClassification				
	RunTime				
	InstitutionalBinding	FundingInstitution			
		HostingInstitution			
		PrincipalInvestigator			
		RelationConnection			
	OfflineProject	Title			
		ThematicClassification			
		RunTime			
		InstitutionalBinding	FundingInstitution		
			HostingInstitution		
	PrincipalInvestigator				
	RelationConnection				
	URI.WayBackMachine				
	Identifier				
	RightLicense				
	NavigationLanguage				
	Content	ProjectDocumentation	ProjectDescription		
			WorkingGroupDescription		
			ActivitiesSchedule		
			PublicationsList		
			CallforPapers		
OtherAnnouncement					
FactsRepository		Facts	Dictionary		
			Bibliography		
			Encyclopedia		
		SourceEdition	Transcription		
			DigitizedPrint		
CollaborationTool		DigitizedManuscript			
		DigitizedArt			
	VideoSound				
	DidacticMaterial				
Other					

Inductive classification of digital objects in scientific philosophy (dopho)	Definitions	Allowed values	Required/recommended/optional;
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			Syntax (once/repeatable)
DigitalObjects	Base property for Dopho classification. Positive property activates classification.	true	required; once
DigitalObjectType	A rough classification of the media types the digital object describes best.	Controlled vocabulary: repository, text repository, research data repository, factual database, encyclopedia, dictionary, bibliography, teaching materials platform, announcement platform, project web site, department web site, graduate school web site, conference web site, blog, podcast, mobile application, tba	required; repeatable
Title	The name the digital object – not its potential offline instance – is known.	free text	required; repeatable
RunTime	Period of time relevant to the digital object. dopho:RunTime is used to describe the running process of digital objects or offline projects. As an occurrent entity it contains the start and end of activities.	yyyy/mm/dd – yyyy/mm/dd	required; once
InstitutionalBinding	An department, university, organization, foundation or similar that contributes to the preparation of a digital object.	true/false	optional; repeatable
FundingInstitution	An department, university, organization, foundation or similar that supports the digital object by financial expenses.	free text (name of institution)	optional; repeatable
HostingInstitution	An department, university, organization, foundation or similar that organizes the digital object by providing personnel, or technical supply or premises.	free text (name of institution)	optional; repeatable
PrincipalInvestigator	A principal investigator, chair person, speaker, head, editor, CEO, or other person responsible for the digital object.	free text (name of person); repeat for ORCID	optional; repeatable
RelationConnection	An department, university, organization, foundation or similar that references the digital object or vice versa.	free text (name of institution)	optional; repeatable
OfflineProject	dopho:OfflineProject may cover the offline-online dualism of digital resources (if it is the case). As an independent class, it fulfills the role of an agent to the digital object that is located in its context.	true/false	optional; repeatable
Title	The name under which the offline instance of the digital object – not the object itself – is known.	free text	required; once
ThematicClassification	The primary navigation language used in the digital object. Description of the content the digital object deals with. Vocabulary of Indiana Philosophy Ontology is used here.	free text	required; once
RunTime	Period of time relevant to the digital object.	yyyy/mm/dd – yyyy/mm/dd	required; once
InstitutionalBinding	A department, university, organization, foundation, person or similar that function in a contribution manner in preparation if a digital object.	true/false	optional; repeatable
FundingInstitution	A department, university, organization, foundation or similar that supports the offline instance by financial expenses.	free text (name of institution)	optional; repeatable
HostingInstitution	A department, university, organization, foundation or similar that organizes the offline instance by providing personnel, or technical supply or premises.	free text (name of institution)	optional; repeatable
PrincipalInvestigator	A principal investigator, chairperson, speaker, head, publisher, CEO, or other person responsible for the offline instance.	free text (name of person); repeat for ORCID	optional; repeatable
RelationConnection	A department, university, organization, foundation or similar that references the offline instance or vice versa.	free text (name of institution)	optional; repeatable
URLWayBackMachineURL	A uniform resource locator, web address or archived resource locator or web address that indicates the location of the digital objects within a computer network.	URL	required; repeatable

	Identifier	A persistent identification the digital object is known as and can reached by.	DOI recommended, repeat for other identifiers	required; repeatable
	RightLicence	Any rights information for the digital object.	free text Example: Creative Commons	required; repeatable
	NavigationLanguage	The primary navigation language used in the digital object.	Controlled vocabulary allowed values from ISO-3166-1 alpha-3	required; once
	ThematicClassification	Description of the content the digital object deals with. Vocabulary of Indiana Philosophy Ontology is used here.	controlled vocabulary according to InPho	required; repeatable
	Content	Content describes the purpose of a digital object, the information provided to comply information needs.	true/false	required; once
	ProjectDocumentation	A “true” value indicates the availability of information on a related project.	true/false	required; once
	ProjectDescription	A “true” value indicates the availability of information on the purpose of the related project.	true/false	required; once
	WorkingGroup Description	A “true” value indicates the availability of information on the related researchers or working group members.	true/false	required; once
	ActivitiesSchedule	A “true” value indicates the availability of information on current events taking place in relation to the subject, the offline project, or the digital object.	true/false	required; once
	PublicationsList	A “true” value indicates the availability of register of literature published by related researchers or in relation to the subject.	true/false	required; once
	CallforPapers	A “true” value indicates the availability of public tender for content related contribution to research activities as workshops, conferences or text projects.	true/false	required; once
	Other Announcement	A “true” value indicates the availability of any other tender as job advertisement or scholarship opportunities.	true/false	required; once
	FactsRepository	A “true” value indicates the availability scholarly data and repositories.	true/false	required; once
	Facts	A “true” value indicates the availability of scholarly data.	true/false	required; once
	Dictionary	A “true” value indicates the availability of vocabulary via the digital object.	true/false	required; once
	Bibliography	A “true” value indicates the availability of a list presenting relevant literature referring to a subject or – not a research group – via the digital object.	true/false	required; once
	Encyclopedia	A “true” value indicates the availability of a reference work or compendium of summaries of information via the digital object.	true/false	required; once
	SourceEdition	A “true” value indicates the availability of scholarly literature or other sources.	true/false	required; once
	Transcription	A “true” value indicates the availability of transcribed text of e.g. historic sources via the digital object.	true/false	required; once
	DigitizedPrint	A “true” value indicates the availability of digital copied prints of e.g. historic sources via the digital object.	true/false	required; once
	DigitizedManuscript	A “true” value indicates the availability of digital copied manuscripts of e.g. historic sources via the digital object.	true/false	required; once
	DigitizedArt	A “true” value indicates the availability of digital copied artwork of e.g. historic sources via the digital object.	true/false	required; once
	VideoSound	A “true” value indicates the availability of sounds and film material of e.g. conferences, interviews, documentations or podcasts via the digital object.	true/false	required; once
	CollaborationTool	A “true” value indicates the availability of resources for facilitating interaction in research.	true/false	required; once
	AnnotatingTool	A “true” value indicates the availability of resources for facilitating text work.	true/false	required; once
	CommentingTool	A “true” value indicates the availability of resources for facilitating text discussion with other researchers.	true/false	required; once

		NetworkingTool	A “true” value indicates the availability of resources for facilitating general exchange with other researchers.	true/false	required; once
		DidacticMaterial	A “true” value indicates the availability of resources for teaching.	true/false	required; once
		Other	Everything relevant to the digital object that does not fit into one of the other categories.	Free text	optional; repeatable

2.2 Mapping

In order to comply with the recommendation to reuse established metadata schemas by Arp, Smith and Spear, a mapping of metadata sets will be performed to identify those elements that can be introduced into the projected ontology of digital objects. To this end, some metadata schemas coming into consideration are presented (2.2.1). Afterwards, the mapping will be accomplished by assigning available elements to the above-mentioned requirements (2.2.2). The mapping will be applied to several examples of digital objects for verification and presented to two postdoc researchers (2.2.3).

2.2.1 Examination of established metadata schemas for adoption or extension

Since we qualified several properties of digital objects in scientific philosophy, it is about time to examine a number of metadata schemas for their ability to match the stated requirements. While these requirements are not covered completely by any established schema, a mostly-sufficient schema can be adopted and subsequently modified or extended to meet the demanded characteristics. Obviously, there are many more metadata sets available that could be examined other than the ones discussed here. For practical reasons, it is less important to apply the mapping to the largest possible number of sets than to find some terms that exactly match the requirements.

The mapping uses the following metadata schemas, which can be considered highly relevant in this context: Dublin Core, DataCite and Re3Data. First of all, we will give an introduction to each schema and its provider.

Dublin Core:

Among the range of metadata schemas used for different purposes, Dublin Core was introduced as a kind of lowest common denominator. Compared to the other schemas, Dublin Core uses a relatively small set of vocabulary terms. The Dublin Core Metadata Element Set (DCMES) consists of fifteen “broad and generic” terms – the “core” terms needed for resource description (Dublin Core 2013). These terms refer to the main areas: i) source content (title, subject, description, type, source, relation, coverage); ii) author (creator, publisher, contributor, rights); and iii) formalities (date, format, identifier, language) (Stock/Stock 2013: 584). On this basic level of formal description, Dublin Core allows for addressing physical as well as digital objects like web pages, videos or images, as well as journals, artwork or archive records. Therefore, Dublin Core enables describing content of quite different character, as well as institutions such as libraries, museums, archive and digital media.

DataCite

DataCite is a non-profit organization with a network of members who provide various services to the research community. DataCite sees itself at the “forefront of helping to transform scholarship and the role of research data in our society” (DataCite 2018: Become a member). Its most important service is the allocation of DOIs for research data and publications. Another service is Re3Data, an index of repositories. While providing technical research infrastructure, DataCite also accomplishes content work, e. g. by establishing standards for research metadata.

Due to the widespread use of DataCite in research data handling, the DataCite schema is also used in many research management initiatives. Member organizations and initiatives like Re3Data, Dryad or GESIS create their metadata sets based on the DataCite schema. On a closer look, it becomes obvious that many properties used by those research centers are guided by the DataCite set, supplemented with specialized terms needed in the particular context of their respective research field. This approach can be a pattern for applying and extending the DataCite set for our purposes as well.

Re3Data

The origin of the Re3Data index of research data repositories was a DFG project in 2012, followed in 2014 by a merge with the Databib repository directory, an initiative much like Re3Data at Purdue University (West Lafayette, Indiana) (Re3Data 2015: 2). Subsequently, the unified repository was again known as Re3Data. In 2015 Re3Data was mandated to DataCite to ensure sustainable service delivery.

The aim of the service is to support the research community by offering a global registry of research data repositories from various disciplines to improve the awareness of researchers, funding institutions, publishers and scholarly institutions for the storage and access of data (Re3Data 2015: 2). Serving the research community, Re3Data publishers are well aware of the high heterogeneity of repositories even on a disciplinary level, while still focusing on the main goal of data storage and retrieval (Pampel et alii 2013: 3). This general openness to different kinds of repositories allows us to take the Re3Data schema into account as a candidate schema for digital objects in philosophy, since digital objects can be understood as information repositories.

2.2.2 Mapping derived from the identified description terms

Having to deal only with categories which are relevant for our purpose is a major advantage of deducing the mapping on the basis of the stated categories. By contrast, performing the mapping the other way around, i.e., beginning with the metadata schemas, would mean a tremendous effort. Since each schema focusses on a specific subject, all of them contain some categories not fitting our purpose. Therefore, the following mapping concentrates on the intersections of the different

schemas while omitting what is beyond the overlap. Moreover, the mapping can be performed regardless of the specific syntax of the schema in terms of possible repetition or the status as “mandatory”, “recommended” or “optional” since there is no relevance in building *our* ontology.

dopho:DigitalObjectType:

Basically, this category corresponds to the inductive expectations of users distinguishing media types of information resources such as editions, podcasts, encyclopedias, or project documentation. The digital object type category is a central component of Dopho addressing the search habits of users. There is no equivalent in the other metadata schemas.

dopho:Title:

This term stands for the main name or title under which a digital object or an offline project is known. There are several possible equivalents possible for addressing dopho:Title: datacite:Title can be used as well as dc:Title or r3d:RepositoryName.

One may consider the Re3Data terms to be preferable since our digital objects can be understood as repositories. This might be too narrow in individual cases and it depends on the specific understanding of “research data” and “repository”. For example, calling the web site of a university research group that provides a description of the subject and the staff a repository, might generate false expectations about the information and the data delivered.

dopho:Runtime:

DataCite offers two terms related to time and date: datacite:PublicationYear and datacite:Date. Datacite:PublicationYear refers to the year the specific “data” were made available to the public. In our context, often dealing with historic texts, it does not seem important to indicate the topic of the digital object on this level of metadata of digital objects; this would rather be expressed in the category referring to the thematic classification. It would be more helpful to obtain information on the resource itself. We could interpret the term as the online release of a digital object although the term definition is clear in referring to the *data*, not the provider.

Neither can the DataCite term datacite:date bridge the gap. It stands for “different dates relevant to the work” and aims at a description of the content as well. Summarizing, DataCite does not provide a valid equivalent for dopho:Runtime. However, this is no surprise since DataCite is a schema for research data and does not treat the providing resource in itself as relevant research data.

Dublin Core can help: dc:Date refers to a “point or period of time” concerning the “lifecycle of the resource”. Aiming at the relevant events of the resource the term, therefore, fits the demand.

Re3Data catches even more aspects which are of interest for us: r3d:StartDate and r3d:EndDate refer to the duration demarcations of a digital object, while the elements r3d:Updated, r3d:Closed and r3s:Offline provide information on whether a repository is still ingesting data as well as on

the actual online activities. These aspects are helpful to understand the present status of an object. This demonstrates once more the special focus of Re3Data on repositories that form – at least in a narrow understanding – just apart of the digital objects we are interested in.

dopho:InstitutionalBinding:

This category expresses a relation to an entity or corporation that contributes to the preparation of a digital object or offline project. This contribution consists in hosting, funding or guidance and instruction of the object or project performed by a single agent. Therefore, the responsible researcher, for example the principal investigator, is located in the institutional binding field as well. This connection of organization structures and human agents might be worthy of further discussion.

Within DataCite, the two aforementioned properties can be addressed easily using `datacite:FundingReference` for information on financial support, whereas `datacite:Creator` or `datacite:Contributor` corresponds with the agent involved with the object or project. In many cases it might not be easy to identify a single person producing the resources. Nevertheless, an individual person might function as principal investigator or spokesperson of the team. Since `datacite:Contributor` accepts a person or an institution “responsible for collecting, managing, distributing, or otherwise contributing” to the resource, `datacite:Contributor` may be used for describing `dopho:FundingInstitution` and `dopho:HostingInstitution` as well as `datacite:PrincipalInvestigator`. This solution can also avoid the difficulties that would emerge from relying on `datacite:GeoLocation` while trying to match the host. `Datacite:GeoLocation` only refers to an actual geological spot, and thus clearly ignores the organizational dimension of the demanded term.

In accordance to the approach of grouping the different forms of binding to an institution or a team, Dublin Core introduces the element `dc:Creator` in order to designate any person, organization or service preparing the resource. At least the hosting institution and the principal investigator can be described through `dc:Creator`. Within Dublin Core, the funding institution as well as the hosting institution can be addressed by using `dc:Publisher` or, less specific, `dc:Contributor`. While `dc:Publisher` designates any entity (person, organization or service) responsible for publishing, the “contributor” is someone who has made any kind of contribution in a much broader sense.

While `datacite:FundingReference` and `datacite:PrincipalInvestigator` can function as equivalents to `dopho:FundingInstitution` and `dopho:PrincipalInvestigator`, `dc:Publisher` covers the gap for `dopho:HostingInstitution`. The proposed allocation is more differentiated than grouping the three properties under `datacite:Contributor`. Nevertheless, `datacite:Contributor` can catch the related institutions invoked as `dopho:RelatedInstitution`.

A second solution for mapping `dopho:FundingInstitution`, `dopho:HostingInstitution` and `dopho:RelatedInstitution` can be realized with `Re3Data`. The element `r3d:Institution` refers to all institutions “funding, creating and/or running the RDR [i.e. Research data repository; ES]”. In combination with the subclasses `r3d:InstitutionName` and `r3d:ResponsibilityType` (the latter allows a controlled vocabulary for values: funding, general, main, sponsoring, technical), we can well match our description aims. Thus for `dopho:PrincipalInvestigator`, there appears to be no equivalent category in `Re3Data`. The only category referring to a person is `r3d:InstitutionalContact` which also is applied to a technical support person.

`dopho:OfflineProject`:

The Dublin Core term `dc:relation` describes a related resource, which at first glance seems to fit offline projects related to a digital object. But the resource is not characterized as “any entity” (and therefore as a person, an organization or a service). Instead, the Dublin Core authors introduced it to describe a digital resource, as the comment “identify the related resource by means of a string” shows. Consequently, the objective of modeling the offline-online dualism of digital objects and their related offline project, cannot be achieved by using `dc:relation`.

There is no appropriate equivalent in the other metadata schemas either.

`dopho:Identifier`:

The assignment of an identifier to a resource can be expressed with `datacite:Identifier` or `dc:Identifier`, both of which require a unique string identifying the resource. `Re3Data` only allows the internal `Re3Data` identifier, using an unambiguous string, or a DOI as values for `r3d:Identifiers` (subclasses: `r3d:Re3data` and `r3d:Doi`). This might be a difficult limitation due to the character of DOI as referring to non-dynamic web content. However, on a lower level the element `r3d:RepositoryIdentifier` (subclasses `r3d:RepositoryIdentifierType` and `r3d:RepositoryIdentifierValue`) permits free choice of a proper identifier.

In general, difficulties arise when trying to assign identifiers to digital objects due to the dynamic character of many digital objects. Identifiers like the DOI refer to a *persistent* version of a digital object, which hardly exists for constantly transforming blogs or working web sites. However, the problem of finding an adequate identifier for dynamic resources does not affect the category itself, which goes well with `datacite:Identifier`, `dc:Identifier` or `r3d:RepositoryIdentifier`.

`dopho:URLWayBackMachineURL`:

The value URL or Wayback Machine archive URL properly fits the element `r3d:RepositoryUrl`. For an additional archive URL, it can be repeated.

Both the URL and the URL of an archived instance by a Wayback Machine as an additional identifier can also be modeled within DataCite and Dublin Core. Considering the URL as an identifier, the DataCite category `datacite:RelatedIdentifier` requires a “globally unique identifier”,

what is complied with the URL. Likewise, in case of an archived version by a Wayback Machine, the archive URL can be recorded with dc:Relation.

dopho:Rights:

The rights declaration shall provide information on the license status of the contents of a digital object for access and reuse. First of all, the DataCite category datacite:Rights meets the requirement. The rights information can be declared and repeated for complex juridical statuses and as well as the license URI can be attached to DataCite as well. In comparison, Dublin Core category dc:Rights is even broader since it includes the rights to the contents held in the resource as well as the rights of the resource itself. According to our purpose, the narrow definition of DataCite seems to be more appropriate. Information on juridical restrictions for the reuse of provided data by a digital object is what is important to us.

The most appropriate description, however, appears to be provided by Re3Data. Other than the most important element (for our purpose), the license of the database (r3d:DatabaseLicense), the repository policy (r3d:Policy), the access to the repository or data (e.g. open, restricted, or closed; r3d:DatabaseAccess, r3d:DataAccess), and the data license can be modelled in the metadata schema. This complex account of the juridical status of a digital object and its contents concerning access and usage may be implemented completely within our schema. On the other hand, here again, we see a restriction to databases and data repositories that limits the scope of digital objects. In order to map all kinds of digital objects, the preferred element for the mapping remains the broader DataCite category datacite:Rights.

dopho:NavigationLanguage:

A term is needed to cover the language(s) used in the digital object interface. The language of the content can differ from the navigation language. By defining the term as the “primary language of the resource”, datacite:Language matches the demands, just like dc:Language and r3d:Language do.

dopho:ThematicClassification:

Like datacite:Subject, dc:Subject is defined as an element describing the topic of the resource. While DataCite allows free text but recommends using keywords, classifications or codes, Dublin Core prescribes keywords or phrases and classification codes by recommending a controlled vocabulary. Re3Data follows a similar approach: r3d:Subject with the subclasses r3d:Subject-Schema and r3d:SubjectName enables specifying the thematic subject of the resource.

Taking up one of the three terms, the implementation of the InPho category system can be easily performed in terms of a controlled vocabulary. All mentioned terms can be combined with defined code (in that case: InPho) with schema URI and the URI of each single subject term.

dopho:Content:

The dopho:Content property, with its subclasses dopho:ProjectDescription, dopho:FactsRepository and dopho:CollabrationTool is central to the purpose of our ontology. It affects the “heart” of the projected ontology since it concerns the declaration of the function of the digital object and provides a specific description of the information the digital object provides. The interleaving of three levels of relevant classes (dopho:ProjectDescription, dopho:FactsRepository, dopho:CollabrationTool), including subcategories, reveals the need for a differentiated structure of adequate categories.

Dublin Core offers the dc:Type element which can, however, hardly fulfil the requirement since it describes the “nature or genre of the resource” too vaguely to meet what we want to denote with the description element. This also applies to datacite:ResourceType which functions as an “open format” description. Likewise, Re3Data provides an element describing the “type” of the content (r3d:ContentType) that only refers to formal aspects by distinguishing “images” or “raw data”.

On the contrary, the term we are looking for needs to include the inherent idea of purpose, benefit, or function of the digital object, the purpose it was made for or why it should be utilized by users. The practical advantages need to be covered by the element equivalent for dopho:Content.

We may consider to introduce a fourth element set in order to create an appropriate description. The MARC21 library metadata schema contains terms adequate to the purpose expressed in dopho:Content (DNB 2018).¹¹ The repeatable term marc:ContentType matches dopho:FactsRepository, implying different media types distinguished by marc:MediaType (addressing the subclasses dopho:Manuscript, dopho:Print, dopho:Art) and qualified by marc:OriginalLanguageEntry and marc:AlternateGraphicRepresentation if digital reproductions are available.

However, a crucial shortcoming of MARC21 affects all functions dealing with the representation of a research project since it is not able to cover all dimensions of digital objects, like nearly every other presented schema. Thus, there is no possibility to address the description of the project, the presentation of the team, the publications compiled during the project period

¹¹ Since the 1960'ies, the Library of Congress has been developing rules for machine-readable cataloguing called “MARC” by which computers are enabled to use, share and interpret bibliographical metadata. MARC became an international bibliographical standard format due to the substantial position of the Library of Congress. After several revisions, the format was enhanced to the current version, MARC21, in 1999. An XML extension is provided as well (MARCXML).¹¹ By now, MARC is the format with the largest quantity of users. Moreover, there is no other format describing a greater quantity of library data worldwide (Library of Congress 2006). In Germany, the transition to MARC was approved in 2004 in the course of international standardization (DNB 2018).

The set of metadata elements MARC offers, reveals the original purpose of the framework as a library exchange format. Nevertheless, the extraordinarily detailed elaborated scheme containing more than 1300 categories and subcategories covers many of the required information in respect to the intended needs of the present thesis.

nor a schedule of academic events. Any kind of collaboration by public commenting or personal annotations might be addressed within MARC21 by the term `marc:OtherDistinguishing-CharacteristicsOfWorkOrExpression`.

2.2.3 Results of mapping

Weighing the advantages and disadvantages along with the characteristics and the defined properties for an accurate description of digital objects in scientific philosophy, none of the presented metadata sets can completely comply with the requirements – as one might have expected. However, most terms can at least be covered by one of the discussed schemas. Those reusable terms need to be compiled into a constituent data schema as the base of our ontology. Obviously, there are always several ways for an accurate mapping.

Mapping			
Digital Objects in Philosophy Ontology	Dublin Core Ontology	Data Cite Ontology	Re3Data
*dopho:DigitalObjectType			
dopho:Title	dc:Title	datacite:Title	r3d:RepositoryName
dopho:Runtime	dc>Date		*r3d:StartDate *r3d:EndDate +r3d:Updated +r3d:Closed +r3d:Offline
dopho:Institution			
dopho:HostingInstitution	dc:Publisher	datacite:Contributor	*r3d:Institution (r3d:InstitutionName, r3d:ResponsibilityType)
dopho:FundingInstitution		datacite:FundingReference datacite:Contributor	*r3d:Institution r3d:InstitutionName r3d:ResponsibilityType
dopho:PrincipalInvestigator	dc:Creator dc:Publisher dc:Contributor	*datacite:Creator datacite:Publisher datacite:Contributor	
dopho:RelatedInstitution		*datacite:Contributor	
*dopho:OfflineProject			
dopho:Identifier	dc:Identifier	datacite:Identifier	r3d:RepositoryIdentifier (r3d:RepositoryIdentifierType, r3d:RepositoryIdentifierValue)
dopho:URL.WayBackMachineURL	dc:Relation	datacite:RelatedIdentifier	*r3d:RepositoryUrl
dopho:Rights	dc:Rights	*datacite:Rights	r3d:DatabaseLicense r3d:Policy r3d:DataLicense r3d:DatabaseAccess r3d:DataAccess
dopho:NavigationLanguage	dc:Language	datacite:Language	r3d:Language
dopho:ThematicClassification	dc:Subject	datacite:Subject	r3d:Subject (r3d:SubjectScheme, r3d:SubjectName)
dopho:Content		*datacite:ResourceType	
*dopho:ProjectDocumentation			
*ProjectDescription			
*WorkingGroupDescription			
*ActivitiesSchedule			
*PublicationsList			
*CallforPapers			
*OtherAnnouncement			
*dopho:FactsRepository			
*dopho:Facts			
*dopho:Dictionary			
*dopho:Bibliography			
*dopho:Encyclopedia			
*dopho:SourceEdition			
*dopho:Transcription			
*dopho:DigitizedPrint			
*dopho:DigitizedManuscript			
*dopho:DigitizedArt			

	* dopho:VideoSounds		
	*dopho:CollaborationTool		
	*dopho:AnnotatingTool		
	*dopho:CommentingTool		
	*dopho:NetworkingTool		
	*dopho:DidacticMaterial		
	*dopho:CollaborationTool		
dopho:Other		datacite:Description	*r3d:Remarks
			+r3d:Api
			+r3d:Type
* preferred element for mapping			
+additional aspect useful for mapping			

Mapping the metadata sets, we had to deal with two difficulties. One challenge is the dynamic of digital objects affecting the specification of time aspects as well as the choice of an appropriate identifier. As a DOI refers to defined as opposed to dynamic entities, it is questionable whether it is sufficient for web sites containing changing content such as editions publishing regular updates.

The second difficulty concerns an understanding of digital objects as “repositories”, since Re3Data focusses on research data repositories providing retrieval and storage of data. It pushes the limits of the term “repository” to apply the term to arbitrary digital objects, as we saw in the examples of a web site providing information on a research group or a blog containing discussions of current topics. In accordance to the broad perspective of the CASRAI dictionary presented in the first section, Re3Data provides a wide understanding of research data that appears to warrant the proposed approach:

[T]he term research data is defined as digital data being a (descriptive) part of the result of a research process. This process covers all stages of research, ranging from research data generation, which may be in an experiment in the science, an empirical study in the social science or observations of cultural phenomena, to the publication of research results. (Pampel/Vierkant/Scholze/Bertelmann/Kindling et alii 2013: 1).

The extremely wide understanding of data within different disciplinary fields – especially for the humanities (Heidborn 2017: 28) – allows us, in our context, to deal with the concept of a “research data repository” on reasonable grounds. In addition, the possibility to store data in the field of philosophy is less important than in the social sciences or life sciences. Thus, the focus on the storage aspect of repositories Re3Data emphasizes can be neglected for our purposes.

The presented “typology of Research Data Repositories” by Pampel, Vierkant et al. confirms this approach (Pampel/Vierkant/Scholze/Bertelmann/Kindling et al. 2013: 3–6). The publishers of Re3Data distinguish four kinds of research data repositories compatible with the characterization introduced for Dopho: institutional repositories, disciplinary repositories, multidisciplinary repositories and project-specific repositories. Since Dopho concentrates on the field of philosophy there is no need to emphasize the disciplinary aspect that is rather relevant for Re3Data as an encompassing registry of repositories. Furthermore, the institutional aspect is covered by the r3d:Institution term and its child terms, while the classification as a project repository by the

datacite:ResourceType section. Here, Dopho offers a more detailed classification compared to Re3Data's typology of repositories. However, the compatible views on relevant aspects of repositories support the case for adopting Re3Data repository term for our subject.

But we need to countercheck as well: Is Dopho just repeating what Re3Data already does? Actually, Re3Data offers only a single research data repository for philosophy on its registry. Browsing Re3Data by subject, the path *Humanities and Social Science/Humanities/Philosophy* leads to the sections *Practical philosophy*, *Theoretical philosophy* and *History of Philosophy* (Re3Data 2018). Within *History of Philosophy* you find the register "ECHO Cultural Heritage Online" that apparently covers the entire scope of the discipline. The Dopho register of digital objects shows a completely different condition. There, we find lots of records in a quite different manner, contrasting Re3Data. Hence, while adopting the Re3Data approach on research data and repositories, Dopho is not a second Re3Data due to its different content. Operating under the same declaration, Dopho is much more a supplier of a kind of *grey research data*. After all, it appears to be reasonable to apply the Re3Data set of elements to the Dopho ontology for modelling.

The following section will collate the single terms available for reuse and make a decision on which one to adopt, if there are several alternatives. One relevant consideration is finding a balance between the amount of implemented metadata sets and the appropriate terms. As a second step we will introduce Basic Formal Ontology (BFO) as a pattern for unifying the different schemas into a single, consistent ontology schema.

For the most part, the Re3Data metadata schema fits the above-mentioned categories quite well. Despite the lack of a field for digital object, digital object type and offline project – like in every other schema discussed –, most of the other aspects can be addressed and the missing ones can easily be supplemented by DataCite. Moreover, there are some aspects characterized by Re3Data that should be added to our concept.

In this light, the aspects of the binding to an institution as a host or funder of the digital object or the offline project can be described by `r3d:Institution`, specified by the subclasses `r3d:InstitutionName` and `r3d:ResponsibilityType`. It would have been possible to use the DataCite category `datacite:FundingReference` as well, however, since there is no proper expression for the hosting institution in DataCite, we decided for Re3Data in order to harmonize both categories. Despite the decision for Re3Data as the basic metadata schema, the DataCite categories `datacite:Creator` and `datacite:Contributor` will function as a stopgap at this point.

Re3Data categories will also be applied for runtime declaration. With `r3d:StartDate`, `r3d:EndDate` and the enriching information provided by `r3d:Update`, `r3d:Closed` and `r3d:Offline` it accounts best for the characteristics of digital objects with respect to time. For describing an URL, `r3d:RepositoryURL` seems to function best, as discussed earlier. Those additional categories contribute to solving the difficulties of dynamic web sites containing changing content like editions that are subject to amendment.

For five aspects, the solutions provided by the different schema turned out to be equally valid: dopho:Title, dopho:Identifier, dopho:Language, dopho:ThematicClassification and dopho:Other. To keep data harmonization, the Re3Data terms are preferred here as well.

Two more properties cannot be complied accurately by Re3Data and will be compensated by DataCite terms. In favor of a broad account of rights declaration for any kind of digital object we add datacite:Rights to our schema. The “content” issue is the most difficult property to express. As a basic frame for description, we will apply datacite:ResourceType and introduce our subclasses dopho:ProjectDescription, dopho:FactsRepository and dopho:CollaborationTool within.

Re3Data contains further details worthy to include in our metadata set. Accordingly, r3d:Type should be added to our schema since it can classify a single digital object as “governmental”, “multidisciplinary” or other, which would allow us to distinguish the character of an object as, for example, as “professional” or “non-academic”; what seems to be appropriate to qualify the description of entities such as blogs or podcasts. Furthermore, the element addressing an available API (r3d:Api) is a helpful term to adopt. By implementing API information, e.g. OAI-PMH, it becomes easy to estimate the effort for harvesting.

Overview of complete mapping:	
dopho:DigitalObject	
dopho:DigitalObjectType	
r3d:RepositoryName	
r3d:StartDate	
r3d:EndDate	
r3d:Update	
r3d:Closed	
r3d:Offline	
r3d:Institution	
	r3d:InstitutionName
	r3d:ResponsibilityType
	datacite:Creator
	datacite:Contributor
dopho:OfflineProject	
r3d:RepositoryIdentifier	
r3d:RepositoryUrl	
datacite:Rights	
r3d:Language	
r3d:Subject	
	r3d:SubjectScheme
	r3d:SubjectName
datacite:ResourceType	
	dopho:ProjectDocumentation
	ProjectDescription
	WorkingGroupDescription
	ActivitiesSchedule
	PublicationsList
	CallforPapers
	OtherAnnouncement
	dopho:FactsRepository
	dopho:Facts
	dopho:Dictionary
	dopho:Bibliography
	dopho:Encyclopedia
	dopho:SourceEdition
	dopho:Transcription
	dopho:DigitizedPrint
	dopho:DigitizedManuscript
	dopho:DigitizedArt
	dopho:VideoSounds
	dopho:CollaborationTool
	dopho:AnnotatingTool

	dopho:CommentingTool
	dopho:NetworkingTool
	dopho:DidacticMaterial
r3d:Remarks	
r3d:Api	
r3d:Type	

As a result, we recognize that to address all formulated requirements according to our purpose, we need to merge existing ontologies into a complex one due to the reasons described above. Useful elements come from the InPho ontology for subject indexing via a controlled vocabulary as well as the Re3Data ontology, introducing single terms from DataCite ontology. In the following ontology building we will see that we do not need to map all properties as classes connected by object properties but as data properties in order to assign specific literals.

2.2.4 A BFO-based ontology proposal

The method of choice for merging is using a major ontology. The Basic Formal Ontology (BFO) is an upper-level ontology which was created for supporting information retrieval, analysis and integration from different fields in science and beyond (GitHub: BFO 2018). As an upper-level ontology, BFO is able to encompass several domain ontologies which cover knowledge on a specific subject. That is why it does not contain any specialized terms which would properly fall within the coverage domains of an individual discipline. BFO is designed in a very basic or “small” manner (GitHub: BFO 2018). Currently, BFO is used by “some hundreds” of ontology projects worldwide, including research consortia, but also government agencies (Spear/Ceusters/Smith 2016: 113). In 2002, BFO evolved within the scope of the “Forms of Life” project funded by Volkswagen Stiftung.

The main pattern governing BFO is the distinction between entities “occurring” or “consisting”. “Continuants” represent “objects, attributes, and locations” that “exist in full at any time at which they exist at all”, whereas “occurents” “include processes and temporal regions” that “happen in time” and, in contrast, have temporal parts (for example, the beginning, middle, and end of a cricket [match; ES]) (Spear/Ceusters/Smith 2016: 104).

This distinction turns out to be difficult due to the simple fact that many objects have been created at a certain time; likewise, every human person was born and will die, yet is still rated as continuant by BFO (Arp/Smith/Spear 2015: 88). *Within the context* of the continuant life of a person, the named cricket match might accordingly be a single occurrence. Anyway, the context of history of the mankind, the life of the cricket player itself is an occurrence – not to mention this one single match in her career. Thus, the distinction of continuants and occurents in the BFO turns out to be related to its specific context. Despite natural laws that appear to be universal, the declaration of continuants seems to depend on the context somethings occurs, or appears to be continuant in. Although there are further philosophical problems emerging from the distinct

approach of BFO's strict definitions of bivalence, we will apply it in order to merge the depicted ontology terms from different provenances accurately.

The next stage is to fit the identified terms within the structure of BFO in order to attain an ontology. Here again, it would be appreciated to be able to rely on an already-performed mapping of Re3Data terms and DataCite terms to BFO categories – either for total adoption or at least for discussion in the following mapping. Apparently, there are no such mappings in the research literature, so we need to perform the mapping ourselves. Despite it turned out during ontology building that some properties should rather be modeled as data properties (for the purpose to include specific values for the described object) we treat them firstly in context of BFO equally as classes.

`bfo:IndependentContinuant`:

The BFO authors define `bfo:IndependentContinuant` as one of three subclasses of `bfo:Continuant`. Other than `bfo:IndependentContinuant`, there are `bfo:GenericallyDependentContinuant` and `bfo:SpecificallyDependentContinuant` – thus the dependence on the entity makes for a distinct difference between the terms. In opposition to the other categories, `bfo:IndependentContinuant` is characterized by its independence. The term “dependence” has a special meaning in BFO and is defined by the authors as: “a sense of dependence that implies that the dependent unity is secondary (has diminished concreteness) in relation to the independent continuant that it its bearer” (Arp/Smith/Spear 2015: 90). According, the `bfo:IndependentContinuant` bears qualities and is not dependent on any other continuant.

This characterization turns out to fit the nature of our categories `r3d:Institution`, `datacite:Creator`, `datacite:Contributor`, and `dopho:OfflineProject`. All of these terms refer to entities continuant in time as well as independent of any other entity while bearing several properties. Furthermore, all aspects collected in `bfo:function` such as editions, collaboration tools or project schedules can be modelled as individual independent continuants connected to the specific digital objects using `is_part`-properties. Although this would allow for a simple modelling, to emphasize the character of the digital objects including the purpose they are useful for, we shall model them as `bfo:Function` as described below.

Unlike an independent continuant, a `bfo:SpecificallyDependentContinuant` is characterized by its subordination and relation to another “entity enjoying a larger degree of concreteness” (Arp/Smith/Spear 2015: 95). Their dependence shall be understood as an “existential dependence” in the fundamental sense that a dependent continuant some other entity “in which it inheres (...) must exist also” (Arp/Smith/Spear 2015: 95). This expressed necessity is important in our context. Digital objects seem to be classical dependent entities, however, there is no necessity for: As discussed above, unlike most of the academically-produced web sites presenting research work which are subject to an offline instance, blogs or podcast don't need to be. Contrary

to our earlier expectations, `dopho:DigitalObject` needs to be considered an independent continuant as well.

`bfo:ImmaterialEntity`:

Defined as a subclass of the independent continuant, `bfo:ImmaterialEntity` inherits the aspects of its superior class. In addition, it is distinguished by having no intentional parts. Characterized by this lack of parts (Arp/Smith/Spear 2015: 107)¹², several ongoing properties are supposed to be considered immaterial entities in terms of BFO, such as: `3d:RepositoryName`, `r3d:Institution-Name`, `r3d:ResponsibilityType`, `r3d:RepositoryIdentifier`, `r3d:RepositoryIdentifierType`, `r3d:RepositoryIdentifierValue`, `r3d:RepositoryUrl`, and `r3d:Api`.

`bfo:RelationalQuality`:

Within BFO, the term refers to a dependent stable property that features a value that is actually realized, fully exhibited or manifest in that entity (Arp/Smith/Spear 2015: 96). The *materialization* character of quality stands in contrast to “realizable entities” in BFO: disposition, function and role. `Bfo:Quality` is worthy, considering for matching several properties of our metadata set. However, since quality’s subclass `bfo:RelationalQuality` refers to a plurality of bearers of our property, the expanded term appears to be appropriate for modeling: `r3d:Update`, `r3d:ResponsibilityType`, `datacite:Rights`, `r3d:Language`, `r3d:Subject`, `r3d:SubjectScheme`, `r3d:SubjectName`, `r3d:Remarks`, and `r3d:Type`.

`bfo:Disposition`:

At first glance, `r3d:Closed` and `r3d:Offline` appear to go along with `bfo:RelationalQuality` as well, yet there is no need for them to be already *materialized* (or rather *realized*). As they inhere to an entity, they are dispositions rather than already-realized qualities.

`bfo:Function`:

As a deep classified category, `bfo:Function` inherits several properties from higher-class categories. Hence `bfo:Function` features, in the first place, *potentially materialized continuant entities*. Furthermore, the authors of BFO promote a four-desiderata account of normativity, teleology, epiphenomenalism and accident following M. Artiga (Spear/Ceusters/Smith 2016: 107). In our context, the classification of `datacite:ResourceType`, `dopho:ProjectDocumentation`, `dopho:Facts-Repository`, and `dopho:CollaborationTool` is quite important, since those categories are in the center of the use cases when applying an ontology to user needs. Instead, those properties could be modelled as well as independent entities interlinked to `dopho:DigitalObjects` applying `part_of`-relations. Although this kind of modelling would be easier, we decided for the description as

¹² Accordingly, the „material entity“ is specified as a continuant containing „some portion of matters a part“ (Arp/Smith/Spear 2015: 90).

functions since it appears to express more accurately the specific value of the single digital object to the user.

bfo:ProcessBoundary

The one and only occurrent category applied in our ontology happens to be bfo:ProcessBoundary, referring to r3d:StartDate and r3d:EndDate. Certainly, there are other time-related terms such as r3d:Update, r3d:Closed and r3d:Offline; however, those terms rather appear to be qualities referring to bfo:Quality as stated above. By contrast, the start and end date of a digital object are less independent entities than part of a process limiting the entity. The actual runtime may be ongoing or already elapsed, which affects the application of r3d:EndDate; in any case there will be a release of the object set out by r3d:StartDate.

All considerations discussed above were merged into the ontology presented in the following chart. We tried to model as most as possible information in terms of data properties for easily noting the specific information on an item.

Ontology metadata		
IRI:	http://www.semanticweb.org/etakivilih/ontologies/2018/3/DigitalObjects7	
Date:	07/2018	
Namespace declarations and imported ontologies:		
dopho:	Digital Objects in Philosophy Ontology	
r3d	Re3Data Ontology	http://schema.re3data.org/3-0/re3dataV3-0.xsd
datacite:	DataCite ontology	http://www.sparontologies.net/ontologies/datacite
inpho:	Indiana Philosophy Ontology	https://www.inphoproject.org/owl/ (the monthly Archive file has been slightly modified for implementation)
bfo:	Basic formal Ontology	https://raw.githubusercontent.com/BFO-ontology/BFO/v2.0/bfo.owl
foaf	Friend of a Friend	http://xmlns.com/foaf/spec/20140114.html

Classes:				
Name	Has super-class; Has sub-class, Is domain of, Is in range of, Has members, Is disjoint with	Datatypes	Required/rec ommended/ optional; Syntax (once/repeat able)	BFO allocation
dopho:DigitalObject	is_domain_of: has_DigitalObjectType, is_domain_of: has_RepositoryName, is_domain_of: has_Institution, is_domain_of: has_Institution_Name, is_domain_of: has_Offline_Project, is_domain_of: has_ResponsibilityType, is_domain_of: has_Creator, is_domain_of: has_Contributor, is_domain_of: is_maintained_by, is_domain_of: has_RepositoryIdentifier, is_domain_of: has_RepositoryURL, is_domain_of: has_Subject, is_domain_of: has_ResourceType, is_domain_of: has_Type, is_domain_of: has_thisStartDate, is_domain_of: has_thisEndDate, is_domain_of: has_thisUpdate, is_domain_of: has_thisCloseDate, is_domain_of: has_thisOfflineDate, is_domain_of: has_thisRights, is_domain_of: has_thisLanguage, is_domain_of: has_thisRemarks, is_domain_of: has_thisApi		required; once	bfo:IndependentContinuant
dopho:DigitalObjectType	is_in_range_of: has_DigitalObjectType, is_domain_of: has_thisDigitalObjectType	controlled vocabulary in individuals: dictionary, edition, encyclopedia, image collection, sound collection, project documentation, conference web site, blog, podcast, journal, online journal tba.	required; repeatable	bfo:Quality
r3d:RepositoryName	is_in_range_of: has_RepositoryName, is_domain_of: has_thisRepositoryName	free text in xsd:string	required, repeatable	bfo:ImmaterialEntity
r3d:Institution	is_in_range_of: has_Institution, is_domain_of: has_InstitutionName, is_domain_of: has_ResponsibilityType, is_domain_of: has_Creator, is_domain_of: has_Contributor		optional, repeatable	bfo:IndependentContinuant

	r3d:InstitutionName	is_in_range_of: has_InstitutionName is_domain_of: has_thisInstitutionName	free text (name of institution)/city/ department (optional)/country (controlled vocabulary from ISO 3166-1 alpha-3) in xsd:string	optional, repeatable	bfo:ImmaterialEntity
	r3d:ResponsibilityType	is_in_range_of: has_ResponsibilityType is_domain_of: has_thisResponsibilityType	controlled vocabulary in individuals: e.g. organizing institution, funding institution, publishing institution tba.	optional, repeatable	bfo:Quality
	datacite:Creator	is_in_range_of: has_Creator is_domain_of: has_thisCreator	free text (name of person, ORCID recommended) in xsd:string	optional, repeatable	bfo:IndependentContinuat
	datacite:Contributor	is_in_range_of: has_Contributor is_domain_of: has_thisContributor	free text (name of person, ORCID recommended) in xsd:string	optional, repeatable	bfo:IndependentContinuant
	dopho:OfflineProject	is_in_range_of: is_maintained_by is_domain_of: has_Institution is_domain_of: has_thisOfflineProjectName	free text in xsd:string	optional, repeatable	bfo:IndependentContinuant
	r3d:RepositoryIdentifier	is_in_range_of: has_RepositoryIdentifier is_domain_of: has_thisRepositoryIdentifierType is_domain_of: has_thisRepositoryIdentifierValue	free text in xsd:string, DOI recommended	required, repeatable	bfo:ImmaterialEntity
	r3d:Subject	is_in_range_of: has_Subject is_domain_of: has_SubjectScheme		required	bfo:Quality
	r3d:SubjectScheme	is_in_range_of: has_SubjectScheme is_domain_of: has_thisSubjectName	InPho categories in xsd:string; additional other indication as: free text in xsd:string	required, repeatable	bfo:Quality
	datacite:ResourceType	is_range_of: has_ResourceType is_domain_of: has_ProjectDocumentation is_domain_of: has_FactsRepository is_domain_of: has_CollaborationTool		required, repeatable	bfo:Function
	dopho:ProjectDocumentation	is_in_range_of: has_ResourceType is_domain_of: has_thisProjectDocumentation	controlled vocabulary in individuals: ProjectDescription, WorkingGroupDescription, ActivitiesSchedule, PublicationsList, Other Announcements, tba	optional, repeatable	bfo:Function
	dopho:FactsRepository	is_in_range_of: has_ResourceType is_domain_of: has_thisFactsRepository	controlled vocabulary in individuals: Dictionary, Bibliography, Encyclopedia, Transcription, DigitizedPrint, DigitizedManuscript, DigitizedArt, tba	optional, repeatable	bfo:Function
	dopho:CollaborationTool	is_in_range_of: has_ResourceType is_domain_of: has_thisCollaborationTool	Controlled vocabulary in individuals: AnnotatingTool, CommentingTool, NetworkingTool, DidacticMaterial	optional, repeatable	bfo:Function

Object properties:		
Name:	has_domain:	is_in_range_of:
has_DigitalObjectType	dopho:DigitalObject	controlled vocabulary in individuals: dictionary, edition, encyclopedia, image collection, sound collection, project documentation, conference web site, blog, podcast, journal, online journal tba.
has_Institution	dopho:DigitalObject dopho:OfflineProject	r3d:Institution
has_InstitutionName	r3d:Institution	r3d:InstitutionName
is_maintainedBy	dopho:DigitalObject	dopho:OfflineProject
has_OfflineProject	dopho:DigitalObject	dopho:OfflineProject
has_ResponsibilityType	r3d:Institution	r3d:ResponsibilityType
has_Creator	dopho:DigitalObject	datacite:Creator
has_Contributor	dopho:DigitalObject	datacite:Contributor
is_maintained_by	dopho:DigitalObject	dopho:OfflineProject
has_RepositoryIdentifier	dopho:DigitalObject	r3d:RepositoryIdentifier
has_RepositoryIdentifierType	r3d:RepositoryIdentifier	r3d:RepositoryIdentifierType
has_RepositoryIdentifierValue	r3d:RepositoryIdentifier	r3d:RepositoryIdentifierValue
has_RepositoryURL	dopho:DigitalObject	r3d:RepositoryURL
has_Subject	dopho:DigitalObject	r3d:Subject
has_SubjectScheme	r3d:Subject	r3d:SubjectScheme
has_SubjectName	r3d:Subject	r3d:SubjectName
has_ResourceType	dopho:DigitalObject	datacite:ResourceType
contains_ProjectDocumentation	datacite:ResourceType	dopho:ProjectDescription
contains_FactsRepository	datacite:ResourceType	dopho:FactsRepository
contains_CollaborationTool	datacite:ResourceType	dopho:CollaborationTool
has_Type	dopho:DigitalObject	controlled vocabulary in individuals:academic, governmental, popular science tba

Data properties:		
Name:	domain:	literal
has_thisRepositoryName	RepositoryName	Free text in xsd:string
has_thisStartDate	dopho:DigitalObject	yyyy-mm-dd, yyyy-mm, yyyy, in r3d:dateFormat
has_thisEndDate	dopho:DigitalObject	yyyy-mm-dd, yyyy-mm, yyyy, in r3d:dateFormat
has_thisUpdate	dopho:DigitalObject	yyyy-mm-dd, yyyy-mm, yyyy, in r3d:dateFormat
has_thisCloseDate	dopho:DigitalObject	yyyy-mm-dd, yyyy-mm, yyyy, in r3d:dateFormat
has_thisOfflineDate	dopho:DigitalObject	yyyy-mm-dd, yyyy-mm, yyyy, in r3d:dateFormat
has_thisInstitutionName	r3d:InstitutionName	free text (name of institution)/city/department (optional)/country (controlled vocabulary from ISO 3166-1 alpha-3) in xsd:string
has_thisCreator	datacite:Creator	free text (name of person, ORCID recommended) in xsd:string
has_thisContributor	datacite:Contributor	free text (name of person, ORCID recommended) in xsd:string
has_thisOfflineProjectName	dopho:OfflineProject	free text in xsd:string
has_thisRepositoryIdentifierType	r3d:RepositoryIdentifier	free text in xsd:string, DOI recommended
has_thisRepositoryIdentifierValue	r3d:RepositoryIdentifier	free text in xsd:string, DOI recommended
has_thisRights	datacite:Rights	free text in xsd:string, example: CC BY-SA
has_thisLanguage	r3d:Language	controlled vocabulary in xsd:language
has_thisSubjectName	r3d:SubjectScheme	InPho categories in xsd:string; additional other indication as: free text in xsd:string
has_thisRemarks	r3d:Remarks	free text in xsd:string
has_thisApi	r3d:Api	free text in xsd:string

2.3 Evaluation

The argument so far has yielded classification requirements such as: i) reference to search expectations by displaying major media types of digital objects, ii) potential dualism of an offline and online tier of the instance, iii) awareness of different information functions according to the provided content, iv) processability of different formats and on machines. These criteria set the scale for evaluation.

The following practical trial prepares the evaluation. It contains a classification of digital objects using the Dopho ontology (2.3.1) as well as interviews with experts on benefits and further improvements of Dopho and a potential Dopho application in a web portal (2.3.2).

2.3.1 Application on examples

On the foundation outlined above we can put the ontology design to the test, applying it to already-discussed instances as well as to instances not respected yet. For the different types of digital objects introduced on a preliminary level, this results in the values listed in the charts below.

Generally speaking, describing instances of digital objects using the Dopho ontology works well. Yet there are some minor aspects to improve. The first issue affects the use of DOI as an identifier (i), the second deals with a stronger connection to the term `r3d:institution` and the specific function of the described digital object as a funding or hosting agent and others in `r3d:ResponsibilityType` (ii). From the new example of a digital object enforcing a negative embargo due to copyright laws, we can learn more about limited content access periods (iii). A last modification concerns an improvement by introducing a term for the geolocation of the offline instance (iv). First, the master set is presented, followed by several examples:

Complete master set		
dopho:DigitalObject		true
dopho:DigitalObjectType		
r3d:RepositoryName		
r3d:StartDate		
r3d:EndDate		
r3d:Update		
r3d:Closed		
r3d:Offline		
r3d:Institution		true
	r3d:InstitutionName	
	r3d:ResponsibilityType	
	datacite:Creator	
	datacite:Contributor	
	dopho:OfflineProject	
r3d:RepositoryIdentifier		true
	r3d:RepositoryIdentifierType	
	r3d:RepositoryIdentifierValue	
r3d:RepositoryUrl		
datacite:Rights		
r3d:Language		
r3d:Subject		true
	r3d:SubjectScheme	
	r3d:SubjectName	
datacite:ResourceType		true
	dopho:ProjectDocumentation	
	dopho:ProjectDescription	
	dopho:WorkingGroupDescription	
	dopho:ActivitiesSchedule	

	dopho:PublicationsList	
	dopho:CallforPapers	
	dopho:OtherAnnouncement	
	dopho:FactsRepository	true
	dopho:Facts	
	dopho:Dictionary	
	dopho:Bibliography	
	dopho:Encyclopedia	
	dopho:SourceEdition	true
	dopho:Transcription	
	dopho:DigitizedPrint	
	dopho:DigitizedManuscript	
	dopho:DigitizedArt	
	dopho:VideoSounds	
	dopho:CollaborationTool	true
	dopho:AnnotatingTool	
	dopho:CommentingTool	
	dopho:NetworkingTool	
	dopho:DidacticMaterial	
	r3d:Remarks	
	r3d:Api	
	r3d:Type	

The following instance of “Perseus digital Library” gives an almost complete dataset.

Application on instances: Perseus digital Library		
dopho:DigitalObject		true
dopho:DigitalObjectType		Edition
r3d:RepositoryName		Perseus 4.0
r3d:RepositoryName		Perseus Hopper
r3d:StartDate		1987
r3d:Update		2017/05/01
r3d:Institution		True
r3d:InstitutionName		Tufts University/Medford, Massachusetts/USA
r3d:InstitutionName		Department of the Classics, Tufts University/Massachusetts/USA
r3d:ResponsibilityType		Publishing Institution
r3d:ResponsibilityType		Funding Institution
datacite:Creator		Gregory R. Crane
datacite:Contributor		Alpheios Project
datacite:Contributor		Andrew W. Mellon Foundation
datacite:Contributor		Institute of Museum and Library Services
datacite:Contributor		National Endowment for the Humanities
datacite:Contributor		National Science Foundation
dopho:OfflineProject		false
r3d:RepositoryIdentifier		true
r3d:RepositoryIdentifierType		URL
r3d:RepositoryIdentifierValue		http://www.perseus.tufts.edu/hopper/
r3d:RepositoryUrl		http://www.perseus.tufts.edu/hopper/
datacite:Rights		Open source
r3d:Language		en
r3d:Subject		true
r3d:SubjectScheme		InPho
r3d:SubjectName		History of philosophy
r3d:SubjectName		Ancient philosophy
r3d:SubjectName		Greek and Roman materials, 19th century American, renaissance materials, Richmond Times-dispatch; English translations
datacite:ResourceType		true
dopho:ProjectDocumentation		true
dopho:ProjectDescription		true
dopho:WorkingGroupDescription		true
dopho:ActivitiesSchedule		false
dopho:PublicationsList		true
dopho:CallforPapers		false
dopho:OtherAnnouncement		true
dopho:FactsRepository		true
dopho:Facts		true
dopho:Dictionary		true
dopho:Bibliography		true
dopho:Encyclopedia		false
dopho:SourceEdition		true

	dopho:Transcription	true
	dopho:DigitizedPrint	false
	dopho:DigitizedManuscript	false
	dopho:DigitizedArt	false
	dopho:VideoSounds	false
	dopho:CollaborationTool	false
r3d:Remarks	Text in Greek, Latin and Arabic, English translations	
r3d:Api	Download all text as XML text files on http://www.perseus.tufts.edu/hopper/opensource/download	
r3d:Type	academic	

Yet, the dataset reveals the difficulty of Dopho to allocate an agent – an institution or contributor – its specific contributing role to an offline project or digital object (the discussion follows below, see iii).

The “Europeana” dataset presents the example of a collection containing sounds, graphics, photos, art, digitized material and others. The difficulty is to capture the 27 languages Europeana can be operated in. Technically it is supposed to map all these languages. Unfortunately, this also affects the description – here cited in German. Like with Perseus, the Europeana dataset had to reiterate the URL as an identifier property due to the lack of other identifiers.

Application on instances: Europeana		
	dopho:DigitalObject	true
	dopho:DigitalObjectType	image collection
	dopho:DigitalObjectType	sound collection
	r3d:RepositoryName	Europeana Collections
	r3d:StartDate	2009/12/02
	r3d:Update	2018/02/28
	r3d:Institution	true
	r3d:InstitutionName	Europeana Foundation/Den Haag/NLD
	r3d:ResponsibilityType	Publishing Institution
	r3d:ResponsibilityType	Funding Institution
	datacite:Contributor	European Union
	dopho:OfflineProject	false
	r3d:RepositoryIdentifier	true
	r3d:RepositoryIdentifierType	URL
	r3d:RepositoryIdentifierValue	https://www.europeana.eu
	r3d:RepositoryUrl	https://www.europeana.eu
	datacite:Rights	All texts are CC BY-SA, images and media licensed individually.
	r3d:Language	EN
	r3d:Language	DE
	r3d:Language	FR
	r3d:Subject	true
	r3d:SubjectScheme	InPho
	r3d:SubjectName	Aesthetics and philosophy of art
	r3d:SubjectName	Continental philosophy
	r3d:SubjectName	History of Philosophy
	datacite:ResourceType	true
	dopho:ProjectDocumentation	true
	dopho:ProjectDescription	true
	dopho:WorkingGroupDescription	false
	dopho:ActivitiesSchedule	true
	dopho:PublicationsList	false
	dopho:CallforPapers	false
	dopho:OtherAnnoucement	true
	dopho:FactsRepository	true
	dopho:Facts	false
	dopho:SourceEdition	true
	dopho:Transcription	false
	dopho:DigitizedPrint	true
	dopho:DigitizedManuscript	true
	dopho:DigitizedArt	true
	dopho:VideoSounds	trze
	dopho:CollaborationTool	true
	dopho:AnnotatingTool	true

	dopho:CommentingTool	false
	dopho:NetworkingTool	false
	dopho:DidacticMaterial	true
r3d:Remarks		selfdeclaration: Europeana Collections bietet Zugang zu mehr als 50 Millionen Objekten in digitalisierter Form – Büchern, Musik, Kunstwerken und mehr aus tausenden europäischen Archiven, Bibliotheken und Museen zur gemeinsamen Nutzung im Interesse von Kunstgenuss, Bildung und Forschung. spezielle Themensammlungen zu Kunst, Mode, Musik, Fotografie und Erstem Weltkrieg umfassen Galerien, Blogs und Ausstellungen.
r3d:Api		Europeana Api
r3d:Type		public, academic

In contrast, we find an ISSN operating as an identifier in the “Stanford Encyclopedia” dataset.

Application on instances: Stanford Encyclopedia		
	dopho:DigitalObject	true
	dopho:DigitalObjectType	encyclopedia
	r3d:RepositoryName	Stanford Encyclopedia of Philosophy
	r3d:RepositoryName	SEP
	r3d:StartDate	1995
	r3d:Update	frequently
	r3d:Institution	true
	r3d:InstitutionName	The Metaphysics Research Lab, Center for the Study of Language and Information, Stanford University/California/USA
	r3d:InstitutionName	Department of Philosophy/Stanford/California/USA
	r3d:InstitutionName	Stanford University/California/USA
	r3d:ResponsibilityType	publishing institution
	r3d:ResponsibilityType	funding institution
	datacite:Creator	Edward N. Zalta
	datacite:Contributor	The Metaphysics Research Lab, Stanford University
	dopho:OfflineProject	false
	r3d:RepositoryIdentifier	true
	r3d:RepositoryIdentifierType	ISSN
	r3d:RepositoryIdentifierValue	ISSN-1095-5054
	r3d:RepositoryUrl	https://plato.stanford.edu/index.html
	datacite:Rights	CC-by
	r3d:Language	En
	r3d:Subject	True
	r3d:SubjectScheme	InPho
	r3d:SubjectName	Philosophy
	datacite:ResourceType	true
	dopho:ProjectDocumentation	true
	dopho:ProjectDescription	true
	dopho:WorkingGroupDescription	true
	dopho:ActivitiesSchedule	false
	dopho:PublicationsList	false
	dopho:CallforPapers	false
	dopho:OtherAnnoucement	true
	dopho:FactsRepository	true
	dopho:Facts	true
	dopho:Dictionary	false
	dopho:Bibliography	true
	dopho:Encyclopedia	true
	dopho:SourceEdition	false
	dopho:CollaborationTool	false
	r3d:Type	academic

The following dataset of the Normative Orders Cluster of Excellence gives an impression of the representation of an institution.

Application on instances: Normative Orders		
	dopho:DigitalObject	true
	dopho:DigitalObjectType	Project documentation
	r3d:RepositoryName	Normative Orders
	r3d:RepositoryName	Die Herausbildung normativer Ordnungen
	r3d:StartDate	2013
	r3d:Update	frequently

	r3d:Institution	true
	r3d:InstitutionName	Formation of Normative Orders Cluster of Excellence, Goethe-University
	r3d:InstitutionName	Goethe-University Frankfurt/GER
	r3d:InstitutionName	Technische Universität Darmstadt/GER
	r3d:InstitutionName	Institut für Sozialforschung/Frankfurt/GER
	r3d:InstitutionName	Froebenisus Institut/Frankfurt/GER
	r3d:ResponsibilityType	hosting Institution
	r3d:ResponsibilityType	funding institution
	datacite:Creator	Rainer Forst
	datacite:Contributor	DFG
	dopho:OfflineProject	Cluster of Excellence Normative Orders
	r3d:RepositoryIdentifier	true
	r3d:RepositoryIdentifierType	URL
	r3d:RepositoryIdentifierValue	http://www.normativeorders.net/en/
	r3d:RepositoryUrl	http://www.normativeorders.net/en/
	datacite:Rights	
	r3d:Language	en/de
	r3d:Subject	true
	r3d:SubjectScheme	InPho
	r3d:SubjectName	Continental philosophy
	r3d:SubjectName	Contemporary philosophy
	r3d:SubjectName	Social and political philosophy
f	r3d:SubjectName	Feminist philosophy
	datacite:ResourceType	true
	dopho:ProjectDocumentation	true
	dopho:ProjectDescription	true
	dopho:WorkingGroupDescription	true
	dopho:ActivitiesSchedule	true
	dopho:PublicationsList	true
	dopho:CallforPapers	true
	dopho:OtherAnnouncement	true
	dopho:FactsRepository	true
	dopho:Facts	false
	dopho:SourceEdition	true
	dopho:Transcription	false
	dopho:DigitizedPrint	false
	dopho:DigitizedManuscript	false
	dopho:DigitizedArt	false
	dopho:VideoSounds	true
	dopho:CollaborationTool	false
	r3d:Type	academic

i) As an international standard, the Dopho ontology would appreciate to support and benefit from the Digital Object Identifier specification, DOI. Though, as discussed above, DOI does not register every digital object but it does register *persistent* digital objects. Consequently, several objects accessible via the internet – changing over of time due to user participation or increasing or varying content – cannot be listed DOI as the presented examples indicate. In accordance to this, most digital objects listed above and in the following record are not registered by a DOI.

It is not easy to find a commendable replacement for a recommendation. At least one alternative can be observed in the Stanford Encyclopedia example which is identified by the International Standard Serial Number ISSN. Likewise, the online journal “Sic et Non”, introduced below, makes use of this. The ISSN could be a solution for handling some digital items.

After all, the data set is supposed to deal with the identifier provided by the objects. Thus, it is only reasonable to be open to every kind of identifier. To preserve the required status of r3d:RepositoryIdentifier in the ontology declaration at least the URL can function as identifier.

ii) A second feature in need of improvement can be observed in the record above: the relation between an institution (r3d:InstitutionName) and its responsibility type (r3d:ResponsibilityType). Currently, it remains unclear what kind of relation exists between several institutions – as is indicated for instance in the record for the Perseus Digital Library. While the contribution of datacite:Contributor values is not determined at all, it is also unclear what stake refers to r3d:InstitutionName:Tufts University. Apparently, it is the role of publisher and funder. This is true as well for the Department of Classics at the Tufts University. The ambiguity regarding the relation of responsibility and agent derives from the given order and can easily be avoided by rearranging the terms in a sequence: r3d:InstitutionName is directly followed by r3d:ResponsibilityType, and likewise, datacite:Contributor is followed by r3d:ResponsibilityType. A repetition will need to repeat the whole sequence.iii) The clarification outlined above is supposed to be applied to the datacite.contributer property as well in order to indicate the respective role of the contributing individual or institution.

We also applied the proposed dataset to instances not taken into account yet or of yet unknown properties: The “Sic et Non” online journal, “HOPOS 2018” conference web site, and the “Sein und Streit” podcast. With “Sic et Non”, a journal is represented that is already offline or at least shuttered. While the last issue was published in 2013, the web site was operative till 2017 and can be retrieved by Wayback Machine. As with the Stanford Encyclopedia, “Sic et Non” provides an ISSN for identification and is subject to Creative Commons licenses.

Application on instances: Sic et non	
dopho:DigitalObject	true
dopho:DigitalObjectType	online journal
r3d:RepositoryName	Sic et Non. Zeitschrift für Philosophie/Kultur im Netz
r3d:RepositoryName	Sic et Non. Online Forum for Philosophy and Culture
r3d:StartDate	1995
r3d:EndDate	2013
r3d:Update	False
r3d:Closed	2013
r3d:Offline	2017/11/04
r3d:Institution	True
datacite:Creator	Florian Ehrensperger
r3d:RepositoryIdentifier	True
r3d:RepositoryIdentifierType	ISSN
3d:RepositoryIdentifierValue	ISSN-1431-2395
3d:RepositoryIdentifierValue	ISSN-1431-2395
3d:RepositoryIdentifierValue	ISSN-1431-2395
r3d:RepositoryUrl	http://www.sicetnon.org/
r3d:RepositoryUrl	https://web.archive.org/web/20170711024139/http://www.sicetnon.org:80/index.php/sic/index
datacite:Rights	CC By-NC-ND
r3d:Language	de
r3d:Subject	true
r3d:SubjectScheme	InPho
r3d:SubjectName	Contemporary philosophy
r3d:SubjectName	Philosophy of aesthetics and art
r3d:SubjectName	Social and political philosophy
datacite:ResourceType	true
dopho:ProjectDocumentation	true
dopho:ProjectDescription	true
dopho:WorkingGroupDescription	false
dopho:ActivitiesSchedule	false
dopho:PublicationsList	false
dopho:CallforPapers	false

	dopho:OtherAnnouncement	false
	dopho:FactsRepository	true
	dopho:Facts	false
	dopho:SourceEdition	true
	dopho:Transcription	true
	dopho:DigitizedPrint	false
	dopho:DigitizedManuscript	false
	dopho:DigitizedArt	false
	dopho:VideoSounds	false
	dopho:CollaborationTool	false
r3d:Remarks		Last issue: Volume 13 (2), 2013
r3d:Api		Metadaten: Dublin Core 1.1; Mods 3.4; MARC21; NLM; RFC1806; NLM 3; OpenUrl 1; OpenURN; mEDRA; CrossRef-XML. Gateway: Resolver; METS; DuraCloud-comp.; SWORD-Export.
r3d:Type		academic

An example for a conference web site is provided by HOPOS conference. We can observe the difficulty to store the date of an event that might be of special interest for users consulting Dopho.

Application on instances: HOPOS 2018		
	dopho:DigitalObject	true
	dopho:DigitalObjectType	conference web site
	r3d:RepositoryName	HOPOS 2018
	r3d:RepositoryName	The International Society for the History of Philosophy of Science (HOPOS) Twelfth International Congress
	r3d:StartDate	2018
	r3d:Update	frequently
	r3d:Institution	True
	r3d:InstitutionName	International Society for the History of Philosophy of Science (HOPOS)/Groningen/NLD
	r3d:ResponsibilityType	organizing institution
	datacite:Creator	Carla Rita Palmerino
	datacite:Creator	Audrey Yap
	datacite:Contributor	International Society for the History of Philosophy of Science (HOPOS)
	datacite:Contributor	Centre for the History of Philosophy and Science at Nijmegen
	datacite:Contributor	Groningen Centre for Medieval and Early Modern Thought
	dopho:OfflineProject	Conference taking place in Groningen/Netherlands, from 9-12 July 2018
	r3d:RepositoryIdentifier	true
	r3d:RepositoryIdentifierType	URL
	r3d:RepositoryIdentifierValue	http://www.hopos2018.nl/
	r3d:RepositoryUrl	http://www.hopos2018.nl/
	r3d:Language	NE
	r3d:Subject	true
	r3d:SubjectScheme	InPho
	r3d:SubjectName	Philosophy of science and the sciences
	r3d:SubjectName	History of Philosophy of Science
	datacite:ResourceType	true
	dopho:ProjectDocumentation	true
	dopho:ProjectDescription	true
	dopho:WorkingGroupDescription	false
	dopho:ActivitiesSchedule	true
	dopho:PublicationsList	false
	dopho:CallforPapers	true
	dopho:OtherAnnouncement	true
	dopho:FactsRepository	false
	dopho:CollaborationTool	false
r3d:Remarks		Conference taking place in Groningen/Netherlands from 9-12 July 2018
r3d:Type		academic

iii) The accurate mapping of time on the different levels of digital objects, offline instances, and the content of a topic as well as a formal quality, appears to be a crucial point for the Dopho ontology. When applying Dopho to the “Sein und Streit” podcast, an additional aspect becomes visible.

Application on instances: Sein und Streit		
dopho:DigitalObject		true
	dopho:DigitalObjectType	Podcast
	r3d:RepositoryName	Sein und Streit. Das Philosophiemagazin
	r3d:StartDate	2009
	r3d:Update	daily
	r3d:Institution	true
	r3d:InstitutionName	Deutschlandfunk Kultur/Deutschland Radio/Cologne/GER
	r3d:ResponsibilityType	publisher
	r3d:ResponsibilityType	funder
	datacite:Creator	changing
	datacite:Contributor	changing
	dopho:OfflineProject	Kultur Sein und Streit. Das Philosophiemagazin
	r3d:RepositoryIdentifier	true
	r3d:RepositoryIdentifierType	URL
	r3d:RepositoryIdentifierValue	http://www.deutschlandfunkkultur.de/sein-und-streit.2161.de.html
	r3d:RepositoryUrl	http://www.deutschlandfunkkultur.de/sein-und-streit.2161.de.html
	datacite:Rights	
	r3d:Language	de
	r3d:Subject	true
	r3d:SubjectScheme	InPho
	r3d:SubjectName	Philosophy
	r3d:SubjectName	Contemporary philosophy
	datacite:ResourceType	true
	dopho:ProjectDocumentation	false
	dopho:FactsRepository	true
	dopho:Facts	false
	dopho:SourceEdition	true
	dopho:Transcription	false
	dopho:DigitizedPrint	false
	dopho:DigitizedManuscript	false
	dopho:DigitizedArt	false
	dopho:VideoSounds	true
	dopho:CollaborationTool	false
	r3d:Remarks	Das Philosophiemagazin "Sein und Streit" ist ein akustischer Denkraum. Über Alltägliches und Akademisches, über Sinn und Unsinn.
	r3d:Type	public
	r3d:Type	popular science

Criteria that have not yet been considered refer to the relevant period of time. Due to copyright rules, the digitally available content of the Deutschlandfunk Kultur public radio station has to be deleted after two years. This affects i.e. the “Sein und Streit” philosophy program. This *negative embargo* – i.e. removal after a specific period – has not been conspicuous yet and is not covered by the Dopho terms. At present, the only way to inform about the access to content limited in time is to put a note in r3d:Remarks. A term such as dopho:ContentVanishingPeriod may be considered to be added to the set of elements.

iv) With regard to conceivable search interests concerning a research activity in a specific geolocation, a term referring to the region or country the digital object is located in should be integrated. Since the description focuses on the digital object not being subordinated to a specific location and even less subordinated to certain devices and technical conditions of worldwide access, it might be rather important to monitor the location of offline instances as discussed under the online-offline dualism rubric before.

By locating the offline project in the just described manner, several search queries can be complied with. Queries may be as follows: “Show me all Calls for Papers concerning Hegel

studies, conference language French”, “Show me all conferences taking place this week in the Berlin region”, “What are new, recently-published academic blogs that discuss some of my recent considerations on freedom in the digital era?”

The following section will focus on the practical usage the Dopho ontology can be applied to.

2.3.2 Interview evaluation

In order to get a feeling for the newly-established classification in its practical application in research, the concept was presented to two postdoc researchers on the scientific staff of Osnabrück University (“AN”) and the Cluster of Excellence Normative Orders at Frankfurt University (“VK”).

Since there is no actual frontend implementing the Dopho ontology in practice, the interviews were based on a thought experiment. The participants have been asked to imagine a pursuant search portal for digital objects giving examples on the wide spectrum those items are located on (compare interview scenario given in the chart below). In addition, to give an idea of the projected browsing categories and filtering options, the metadata set was presented to the interview partners. While the interview was performed in German, the metadata set provided was in English.

Questionnaire	
Interview scenario: Imagine there was a search engine for digital objects in scientific philosophy providing tools such as digital editions of scholarly literature, web presentations of conferences and research groups, blogs and podcasts, collaborative web site projects etc.	
1.	What kind of content would you expect (or hope to find) using the sketched search engine? You may indicate some specific digital objects (online tools or information resources).
2.	How would your research benefit from using a special search engine for digital objects?
3.	Which search engines do you already use for searching philosophical content or helpful tools?
4.	How would you proceed using the abovementioned search engine to retrieve information on conferences about Marx that took place in the year 2017? On a scale of 0–10 (where 10 is best), how familiar are you with the research topic “Marx or Marxism”?
5.	How would you proceed using the abovementioned search engine to find any new research activities on Plotinus founded by DFG? On a scale of 0–10 (where 10 is best), how familiar are you with the research topic “Plotinus or Neo-Platonism”?
6.	How would you proceed to find material on current topics in analytical philosophy? On a scale of 0–10 (where 10 is best), how familiar are you with the research topic “analytical philosophy”?
7.	What are your main research interests? How would you proceed to search for new digital objects in your specialization?
8.	Apart from the applications outlined above, what would you appreciate to use such a search engine for?
9.	On a scale of 0–10 (where 10 is best), how much would you appreciate the services of such a search portal for digital objects in philosophy?

Both researchers generally appreciated the prospective services of an integrated search engine as it is developed in the present study (AN and VK both chose 9 on a scale of 0–10, where 10 is best; question 9). The reason for this appears to be obvious, since it is – as both stated – never easy to retrieve relevant research material. As an answer to question 7 concerning the retrieval of new digital tools in his area of specialization, one interview partner answered: “Hmm...Da wären doch jetzt 1000 Möglichkeiten denkbar” (AN). It seems feasible to search for a specific content if an appropriate web service is already known. There are many services used for different goals. Despite this, the default search strategies actually chosen (question 3) based on Google searches.

Information about alternative search engines was only possessed by one of the two interview partners: AN. Moreover, VK estimates search engines provided by libraries (“SowiPort”) to be “not very helpful” (“nicht sehr hilfreich”). VK justifies his view as follows: “Oft finde ich dort nicht die Sachen, die ich suche. Ich hab nicht das Gefühl, einen guten Einblick in aktuelle Geschehnisse zu bekommen“ (VK). Besides the lack of current contents, VK assumes one more disadvantage: “[Ich habe; ES] Angst, dass ich nicht die gleichen Kategorien oder Keywords im

Kopf habe wie die, die angeboten werden“ – a reservation that is true for the projected Dopho search portal as well as for every classification.

Accordingly, there is no specialized search tool (question 3) consulted by VK other than Google. Asked whether they used Google Scholar, JStor or SciHub the answer was negative. Even to retrieve specific journal articles, VK uses Google search. In this sense, VK estimates himself as proceeding in a “strictly explorative” (“rein explorative”) manner through a wide search strategy (VK: “Wenn ich die Suche konkretisiere, habe ich Angst, etwas zu verpassen. Ich fange eher abstrakt an, ohne es zu konkretisieren”). An alternative course of action VK applies is to start with relevant individuals or research institutions explore further from this point. All in all, VK currently prefers this “manual” (“händisches”) procedure from one cited or recommended information to another, over applying the library search tools that are considered as “protracted, lengthy” and leading to “few relevant results” (“zäh, dauert lang und bringt wenig Ergebnisse”).

In contrast, the spectrum of search engines currently used by AN extends from Amazon.de and Zentrales Verzeichnis antiquarischer Bücher (ZVAB; zvab.com) – “only for [bibliographic; ES] research, not for purchase” (AN) – to OPACs of university libraries and research libraries, Academia.edu and theorieblog.de. A “synthesis of functions” (“Synthese von Funktionen”) is welcomed by AN.

The expected content (question 1) primarily affects Call for Papers, workshop announcements and scholarly literature including text editions, archive material and grey literature (AN, VK). Furthermore, research blogs are content of interest to get in touch with current discussions and announcements. Other than the research for information, services for collaboration with fellows are appreciated as well as services for placing or “injecting” one’s own publications (AN: “Einspeisen eigener Produktion”) within the academic discussion. Podcasts and didactic material appear to be less relevant. The interest in research groups at graduate schools or research projects depends on the material provided and on whether there is information and material accessible for reuse.

The statements on desired content and applied research tools are consistent with the results of the preparatory survey of the philosophy FID (Glaser 2015: 6; 13).

An advantage of the projected service based on the Dopho ontology (question 2) is seen in the support of grey literature at an online and offline level (AN: “[...] bereits die Auffindbarkeit von Material, das leicht durch das Sieb des akademischen Kanons rutscht, [ist; ES] sehr nützlich.”). Apparently AN expects advantages for the entire research process, while VK sees the prospective portal rather as an introductory point of entry to the research on a specific topic: The search portal “wäre eine gute Möglichkeit, das Feld auszuleuchten, das ich untersuchen möchte, [...] um zu gucken, was so geht, was ich vielleicht verpassen könnte” (VK).

An apparently false expectation about the service consists in the assumption of a collaboration tool for discussion with fellow researchers and users:

Weiterhin wäre es für den Austausch mit Kolleg*innen, der sich häufig nur zufällig über Konferenzen ergibt, nützlich, sich sowohl mit anderen Nutzer*innen vernetzen als auch über Projekte austauschen zu können. Auch in diesem Zusammenhang wäre interessant, ob und wie eine solche Suchmaschine in der Lage wäre, [...] einen Austausch zu ermöglichen. (AN)

Despite the assumption expressed, the Dopho service itself directly will not provide collaboration tools but will support registering and accessing existing tools, in terms of an aggregator. However, the expressed request may be fulfilled by one of the promoted digital objects. Certainly, it exceeds the scope of the Dopho project.

One more demand going too far – at least at this stage of development – was expressed in the answer to question 8 concerning further usage of the outlined service: A display would be welcome showing the statistical occurrence of keywords in publications sorted by publication years (AN: “[...] eine diskursanalytische Statistik, die zwar keine inhaltlichen Aufschlüsse geben kann, aber zumindest die Verwendung bestimmter Begriffe oder Schlagwörter historisch zuzuordnen vermag.”). Such statistical text mining tools are already established in many services, especially in the area of natural sciences and life sciences (e.g. TIB catalogue or PubMed). Regarding our aim – registering digital objects – the desired statistical display needs to be slightly modified: It should display information on dates concerning the digital object itself or the reference trier of digital information resources instead of release dates of publications.

One more proposal was made by VK who suggests an alert service for calls for papers or other notifications. Based on the Dopho data, calls on a specific topic are supposed to form an automated search query supplying a reminder service to users. The terms `dopho:DigitalObjectType` and `r3d:SubjectScheme` in combination can be applied in order to realize such a service.

Yet, the interviewed researcher commented on the actual functions as well. A multidimensional search facility combining formal properties and thematic classification is demanded (“mehrdimensionale Suchoption”) and envisioned as a synergy of functions of library catalogues, Google Books and Academia.edu. The support of different text genres is identified as a decisive factor as well as the potential storage and export of research results to a reminder list.

The interview also focused on actual search strategies in specific instances. In order to obtain a more differentiated idea through the questions, research within *familiar* topics has been separated from research within *unfamiliar* ones. The same was done for *current* search techniques and those based on the *prospective* search portal.

In the case of specialized search engines already known, the request lead to the observation that Dopho is not actually needed as a guide to the known relevant service. That could be seen in

case of the information request about DFG-funded projects on Plotinus (question 5). Even though, the primary topic “Plotinus” was not familiar to AN (value 2 and 0 for VK on a scale of 0 to 10, where 10 is best), the subordinated subject “DFG project” was apparently known since the DFG’s own database “GEPRIS” was mentioned as an appropriate tool to comply the information need. As Dopho is still being developed, the searches using Dopho would currently only forward to GEPRIS. For a more sophisticated service, the GEPRIS database could be searched directly by Dopho without changing the interface due to a further integration of data under a shared consistent frontend. Certainly, this would be an improvement in usability. However, all of this is still up in the air.

Confronted with the Dopho categories, VK rejected browsing the categories or using the advanced search categories option of Dopho in favor of using the simple search bar (query “DFG Plotin”). This simple search strategy was followed by VK in every queried use cases (questions 4, 5, 6).

In contrast, AN engaged with the classification. He decided to narrow the scope to “HostingInstitution = DFG” and “Thematic Classification = Plotinus”. Unfortunately, this query will lead to the wrong results, since we are looking for DFG in its role as the “funding institution” and not in its contribution to a research project as a “host”. The mistake appears to be of minor relevance and might be provoked by the unfamiliar and foreign-language categories and terms. Nevertheless, it shows the need for suitable terms (in German and English) speaking for themselves.

Similar problems can be discerned in the scenario of a analytic philosophy search topic (question 6). The familiarity with the subject was estimated to be comparable with the “Plotin” topic, rating 2 (AN and VK) on the scale of 10. Yet, AN is aware of the German Society for Analytical Philosophy (Gesellschaft für analytische Philosophie, GAP). Consulting their web site will definitely yield a qualified access to actual research trends. However, the results may be too narrow. With regard to the formulated desire for “grey information” and for “Material, das leicht durch das Sieb des akademischen Kanons rutscht” (AN), searching via such a central institution might exclude some interesting findings, yet it might be a good starting point for retrieval. In this case, the research would benefit from applying Dopho.

Further on, the interview partner AN’s restriction to “thematic classification = analytical philosophy” and “project description = true” would provide him with a number of projects from the area of analytical philosophy, even though the condition for the “up-to-dateness” of current projects has been missed.

Interestingly enough, the searching strategy on research topics estimated as very familiar do not differ widely (AN rates 8 on the scale; question 4 and 7). Only the amount of entry-point web sites is larger. AN differentiates between an active and a passive way of obtaining information. The “active” information retrieval comprises an unrestricted Google search and consulting

thematically relevant web sites. The “passive” procedure consists in following newsletters – which is not actually a solution for the stated information request.

Applying Dopho, the interviewed researcher AN would decide to set “Digital Object Type = Conference” combined with “Title = Marx” or “Subject = Marx” and applying “Runtime = 2017” to restrict the query to the year the events took place. Once again we observe a miscomprehension of Dopho categories since “runtime” does not relate to the date of the event but to the lifespan of the digital object the event is represented on – which is, as in the case of a conference web site, a much earlier date. The difficulties in conveying the meaning of categories originating from an information science context to the user is mainly a communicational problem and can be addressed on the user interface level. Related feedback was given by VK who was puzzled by the complexity of the categories provided: “Auf den ersten Blick bin ich überfordert von der Vielfalt der Kategorien.”

Other than the need for accurate terminology in favor of usability, the interview evaluation reveals a real blind spot of Dopho ontology. Apart from the time declarations of the digital object, the time declaration of the offline project and the potential time declaration of the content (if it is relevant for the subject), there is a lack of information on events proceedings, calls for papers etc.

2.4 Results

The preceding sections approached the project of building an ontology for the special needs of digital objects from different angles. The first rapprochement was worked out by compiling a record of digital objects supposed to be able to be described and promoted by a service based on the projected classification. Visualizing the specific examples allowed deriving certain requirements for the description that needed to be respected in the data set.

These requirements are: i) Awareness of coarse types of digital objects as concession to the primary search interest discerning the interest for facts (e.g. for a text edition) from the interest for collaboration and the interest for project documentation. ii) Attention to the double structure of digital objects. In many cases, digital objects belong to the much broader context of a research project or institution they are representing. iii) Different needs for information can be distinguished by being classified as documenting, facts-driven and collaborative-orientated. As a last requirement, iv) the projected ontology shall be compatible with a wide variety of different formats and media. The evaluation proofed the proper implementation of the requirements.

From discussing several established metadata sets such as Dublin Core set, DataCite set and Re3Data, set we learned that there already are useful elements to adopt for our set of elements. Following the principle of reuse (Arp/Smith/Spear 2015), it was possible to create a schema based primarily on Re3Data terms supplemented by DateCite terms and specific terms related to the

special demands of a digital object philosophy ontology: in short, “Dopho”. On this basis it was possible to compile a Dopho set of elements. The development of the classification went ahead, conscious of the demands established beforehand (i-iv).

Finally, the proposed ontology concept was evaluated in two ways. The first evaluation constituted in applying empiric examples to the ontology design. Those examples contained items recorded in the list and analyzed before as well as items not yet considered. The application test revealed the need for minor adjustments and slight modifications – unsurprisingly, since it has already been noted that an ontology as a representation of the truth will always be subject to improvement in accuracy.

The modifications refer to the term `r3d:RepositoryIdentifier` that will not be recommended to be a DOI anymore. Furthermore, the terms `r3d:InstitutionName` and `r3d:ResponsibilityType` will form a sequence of classes and object properties. Additionally, the term `dopho:ContentVanishingPeriod` will be added. Lastly, stating a geolocation for the offline instance in the term `r3d:InstitutionName` will be declared as a requirement.

Definitions classes:				
Name	Has super-class; Has sub-class, Is domain of, Is in range of, Has members, Is disjoint with	Allowed values	Required/ recommended/ optional; Syntax (once/ repeatable)	BFO allocation
<code>r3d:RepositoryIdentifier</code>	<i>is_in_range_of: has_RepositoryIdentifier</i> <i>is_domain_of: has_thisRepositoryIdentifierType</i> <i>is_domain_of: has_thisRepositoryIdentifierValue</i>	free text in xsd:string, <i>Refers to an identifier; this may be DOI.</i>	required, repeatable	bfo:ImmaterialEntity
<code>r3d:InstitutionName</code>	<i>is_in_range_of: r3d:has_InstitutionName</i> <i>is_domain_of: has_thisInstitutionName</i> <i>is_domain_of: dopho:has_ResponsibilityType</i>	free text (name of institution)/ <i>city/ department (optional)/ country (controlled vocabulary from ISO 3166-1 alpha-3)</i>	optional, repeatable	bfo:ImmaterialEntity
<code>r3d:ResponsibilityType</code>	<i>is_in_range_of: r3d:has_ResponsibilityType</i>	free text (name of institution) e.g. organizing institution, funding institution, publishing institution	optional, repeatable	bfo:Quality
modifications in italic				

Data property		
Name	Domain	literal
<i>dopho:thisContentVanishingPeriod</i>	<i>dopho:DigitalObject</i>	<i>yy/ mm/ dd</i> <i>after yy/ mm/ dd</i>
modifications in italic		

The second evaluation trial was performed by interviewing two postdoc researchers. In general, the selection of content – especially of scholarly literature and grey literature material – was highly appreciated, as well as the attempt to bring together several services in order to support research. The opportunity to publish and discuss own material via external services as well as facilitating the retrieval of collaboration tools were welcomed. In this respect, the interviews have led to similar results as the philosophy FID advance survey that shaped the primarily approach for this project.

However, we can take home two suggestions. The interviews emphasized the need for a better handling of the user interface. The unwieldy terms of metadata sets have to be translated to more common expressions since several misunderstandings were observed in the interview, obviously

caused by unfamiliar terminology. To develop an interface appropriate to the research community's needs, a follow-up action must be taken to include other usability aspects besides suitable declaration must be taken. A second modification concerns the time aspect. Here we need to introduce a term to adapt the ontology to user needs.

Apart from the aforementioned time aspects of the digital object itself, its potential offline instance and the thematic content also stored need to be reflected in the data. Therefore, we introduce `dopho:EventTakingPlace` as data property.

Data property		
Name	Domain	literal
<i>dopho:EventTaking place</i>	<i>dopho:DigitalObject</i>	<i>yy/mm/dd</i>
modifications in italic		

3 Summary of results and outlook

The present study deals with the theoretical background, application scenarios and the practical realization of an ontology of digital objects in the field of philosophical research. In contrast to conventional structures or argumentation, the present study follows a subject-oriented approach of immersing the critical analysis within the other components of the argumentation. Therefore, discussion section as separate text element is dismissed in favor of a continuous critical look at the line of research and argumentation. The goal of a concise and appropriate handling of the research topic benefits from the immersing account of subject orientation for argumentation.

In this sense, a first approximation was performed by collecting information on existing projects pursuing a similar objective with respect to implementation potentials. We briefly presented two examples of actual working portals serving the academic community in the humanities: Philosopher's Index and historicum.net. By reviewing these portals, we were able to situate our endeavor from those other activities. Whereas Philosopher's Index provides philosophical literature by performing a highly specialized content classification, historicum.net offers introductory material on specific topics. Instead, Dopho, the classification of digital objects, is up to structure aggregator services or meta-providers of philosophical information. With respect to the professional needs for optimization of search systems, the use case for our ontology, implemented in an interface, may find its place within the FID philosophy specialized information service at Cologne University Library.

Our considerations led us to the notion of digital objects as a vague concept referring to digital content accessible online or via digital devices. The nature of the content is not clearly limited. The classification as scientific or philosophic needs to especially include the threshold to amateur activities and familiar science fields such as literary studies or history. Furthermore, the transformative character of digital tools, in step with the progress of digitalization requires an open sense of the topic as a *resource of practical relevant information and research data* in a broad understanding of the term. Nevertheless, it was an important interim result to admit, that there will neither be a consistent definition of "digital objects" nor a complete compilation of those items or a finished ontology.

However, for visualization purposes, an empirical compilation of digital objects was compiled. From this list we obtained a first impression of the wide variety of our subject. We introduced an outline of rough types to get a sense for the complex matter, only to discover that those patterns cannot be established unambiguously. Learning from this experience, it was possible to develop four requirements that spanned criteria to assess the ontology. Those criteria also set the standards for rating the results of the research work: i) reference to search expectations by accounting for major media types of digital objects, ii) potential dualism of an offline and online tier of the instance, ii) awareness of user demands for different functions of the specific provided content, iii) processability of differing formats and on different machines.

Analyzing the catalog of digital objects, we were also able to derive several terms supposed to reflect the characteristics of digital objects. On the basis of this inductive created provisional dataset, we were capable of carrying out a mapping to already existing element schemas. The ontology building aimed for an “application ontology”, to use the term introduced by Jansen. As a “reference ontology” for subject indexing we used Indiana University’s InPho ontology.

The mapping followed the principle of reuse of established metadata sets stated by Arp, Smith and Spear. To this end, we drew upon Dublin Core, DataCite and Re3Data schemas since those institutions are popular and their metadata sets widely applied. Dublin Core, especially, is very common globally as it has been employed since the 1960s in libraries, archives, museums etc. DataCite specializes on research data instead, while Re3Data concentrates on research data repositories. The objective of the mapping was not to examine as many concordance models as possible, but one that works out for our purpose, fulfilling the perceived requirements. The review of single terms derived from the inductive compilation of description terms.

In this process, we were again confronted with definition difficulties, considering digital objects as research data repositories. Re3Data addresses most of the demanded properties and fits best as basis concordance. One problem was the scope of the “research data repository” category. Due to the wide comprehension of the repository term by the publishers of Re3data, being aware of the ambiguous conditions of research data on the disciplinary level already (Pampel et al. 2013: 1, 3), the Re3Data dataset can be applied to our subject as a basic concept. DataCite categories supplement the set, and likewise do autonomous-defined categories (dopho:Digital-Object; dopho:DigitalObjectType; dopho:OfflineInstance).

Merging terms from Re3Data, DataCite, and some of our own, on the application ontology side for formal indexing of items, we implemented the subject classification of InPho as a reference ontology by using BFO for the merging process. Although the BFO approach did not convince in detail, integration applying BFO proceeded successfully. The completed representation of the ontology design containing all modifications as results from the reviewing process during evaluation is given below.

To take a first test of the design’s usability, we applied the ontology to some examples of digital objects. Since the benefit for practical use in research is the actual measure for ontology design, a second trial was conducted performing two interviews about the concept with people from the targeted group of philosophy researchers. Both empirical applications showed that the stated requirements are fulfilled by the proposed ontology. Slight modifications were nevertheless necessary: The application of Dopho on instances revealed the need for a close reference of the terms r3d:InstitutionName and r3d:ResponsibilityType. As a result of the evaluation, these terms will form a sequence. Furthermore, an indication of the geolocation field will be declared mandatory, and the recommendation for DOI identifiers is withdrawn in favor of any identifier available.

Nevertheless, one improvement will be a carefully-selected terminology referring to the categories in the frontend to secure good usability. A second difficulty concerned the accurate modeling of time in its diverse aspects. Time should be reflected for the specific runtime of digital objects as well as for the offline project. Time is relevant for thematic classification and also for the described content in case of digitized editors or promoted events. In addition, the occurrence of embargo regulations on the access side needs to be reflected in the terms. To cover all time relevant aspects on the different levels of digital objects, the ontology was expanded by introducing `dopho:EventTakingPlace` and `dopho:ContentVanishingPeriod`.

The modified ontology can be the base structure for a portal delivering three search modes: a free search and an extended search option as well as a browsing option from formal and subject index aspects for narrowing the data via filtering. Since it was not the goal of the study to implement a frontend for the ontology, it can only be envisioning the actual search portal would look like. Utilizing the extended search option, several properties modeled in the terms can be specifically addressed, i. e. title, funding organization, city or institution. As a second feature, a free search bar is a conceivable search option as well applying any query to the whole cluster of metadata information. Users could narrow the data by applying several filters such as language, country, provided research data or repository type.

On this base, services as bookmark option for search results and an alert service on specific information need are considerable, as the interview partner VK proposed during evaluation. In order to ensure a good data quality in general, a service for user maintenance of the database should be integrated in the interface. Users should be given the opportunity to report incorrect or incomplete data or suggest a digital object to be included in the database by filling in a form. As a future project, the ontology might target an extension into social media tools.

A perfect goal for the future Dopho ontology philosophy portal would be an integration of the various services of the aggregated digital objects under one frontend. An expectation already expressed by the interview partner AN. Due to copyright laws, this optimal scenario does not appear to be achievable.

Ontology metadata		
IRI:	http://www.semanticweb.org/etaktivilih/ontologies/2018/3/DigitalObjects7	
Date:	07/2018	
Namespace declarations and imported ontologies:		
dopho:	Digital Objects in Philosophy Ontology	
r3d	Re3Data Ontology	http://schema.re3data.org/3-0/re3dataV3-0.xsd
datacite:	DataCite ontology	http://www.sparontologies.net/ontologies/datacite
inpho:	Indiana Philosophy Ontology	https://www.inphoproject.org/owl/ (the monthly Archive file has been slightly modified for implementation)
bfo:	Basic formal Ontology	https://raw.githubusercontent.com/BFO-ontology/BFO/v2.0/bfo.owl
foaf	Friend of a Friend	http://xmlns.com/foaf/spec/20140114.html

Classes:				
Name	Has super-class; Has sub-class, Is domain of, Is in range of, Has members, Is disjoint with	Datatypes	Required/recommended/optional; Syntax (once/repeatable)	BFO allocation
dopho:DigitalObject	is_domain_of: has_DigitalObjectType, is_domain_of: has_RepositoryName, is_domain_of: has_Institution, is_domain_of: has_InstitutionName, is_domain_of: has_OfflineProject, is_domain_of: has_ResponsibilityType, is_domain_of: has_Creator, is_domain_of: has_Contributor, is_domain_of: is_maintained_by, is_domain_of: has_RepositoryIdentifier, is_domain_of: has_RepositoryURL, is_domain_of: has_Subject, is_domain_of: has_ResourceType, is_domain_of: has_Type, is_domain_of: has_thisStartDate, is_domain_of: has_thisEndDate, is_domain_of: has_thisUpdate, is_domain_of: has_thisCloseDate, is_domain_of: has_thisOfflineDate, is_domain_of: has_thisRights, is_domain_of: has_thisLanguage, is_domain_of: has_thisRemarks, is_domain_of: has_thisApi		required; once	bfo:IndependentContinuant
dopho:DigitalObjectType	is_in_range_of: has_DigitalObjectType, is_domain_of: has_thisDigitalObjectType	controlled vocabulary in individuals: dictionary, edition, encyclopedia, image collection, sound collection, project documentation, conference web site, blog, podcast, journal, online journal tba.	required; repeatable	bfo:Quality
r3d:RepositoryName	is_in_range_of: has_RepositoryName, is_domain_of: has_thisRepositoryName	free text in xsd:string	required; repeatable	bfo:ImmaterialEntity
r3d:Institution	is_in_range_of: has_Institution, is_domain_of: has_InstitutionName, is_domain_of: has_ResponsibilityType, is_domain_of: has_Creator, is_domain_of: has_Contributor		optional; repeatable	bfo:IndependentContinuant
r3d:InstitutionName	is_in_range_of: has_InstitutionName, is_domain_of: has_thisInstitutionName, is_domain_of: dopho:has_ResponsibilityType	free text (name of institution)/city/department (optional)/country (controlled vocabulary from ISO 3166-1 alpha-3) in xsd:string	optional; repeatable	bfo:ImmaterialEntity
r3d:ResponsibilityType	is_in_range_of: has_ResponsibilityType, is_domain_of: has_thisResponsibilityType	controlled vocabulary in individuals: e.g. organizing institution, funding institution, publishing institution tba.	optional; repeatable	bfo:Quality
datacite:Creator	is_in_range_of: has_Creator, is_domain_of: has_thisCreator	free text (name of person, ORCID recommended) in xsd:string	optional; repeatable	bfo:IndependentContinuant
datacite:Contributor	is_in_range_of: has_Contributor, is_domain_of: has_thisContributor	free text (name of person, ORCID recommended) in xsd:string	optional; repeatable	bfo:IndependentContinuant
dopho:OfflineProject	is_in_range_of: is_maintained_by, is_domain_of: has_Institution, is_domain_of: has_thisOfflineProjectName	free text in xsd:string	optional; repeatable	bfo:IndependentContinuant
r3d:RepositoryIdentifier	is_in_range_of: has_RepositoryIdentifier, is_domain_of: has_thisRepositoryIdentifierType, is_domain_of: has_thisRepositoryIdentifierValue	free text in xsd:string, Refers to an identifier; this may be DOI.	required; repeatable	bfo:ImmaterialEntity
r3d:Subject	is_in_range_of: has_Subject, is_domain_of: has_SubjectScheme		required	bfo:Quality
r3d:SubjectScheme	is_in_range_of: has_SubjectScheme, is_domain_of: has_thisSubjectName	InPho categories in xsd:string; additional other indication as: free text in xsd:string	required; repeatable	bfo:Quality
datacite:ResourceType	is_range_of: has_ResourceType, is_domain_of: has_ProjectDocumentation, is_domain_of: has_FactsRepository, is_domain_of: has_CollaborationTool		required; repeatable	bfo:Function
dopho:ProjectDocumentation	is_in_range_of: has_ResourceType, is_domain_of: has_thisProjectDocumentation	controlled vocabulary in individuals: ProjectDescription, WorkingGroupDescription, ActivitiesSchedule, PublicationsList, Other Announcements, tba	optional; repeatable	bfo:Function
dopho:FactsRepository	is_in_range_of: has_ResourceType, is_domain_of: has_thisFactsRepository	controlled vocabulary in individuals: Dictionary, Bibliography, Encyclopedia, Transcription, DigitizedPrint, DigitizedManuscript, DigitizedArt, tba	optional; repeatable	bfo:Function
dopho:CollaborationTool	is_in_range_of: has_ResourceType, is_domain_of: has_thisCollaborationTool	Controlled vocabulary in individuals: AnnotatingTool, CommentingTool, NetworkingTool, DidacticMaterial	optional; repeatable	bfo:Function

Object properties:		
Name:	has_domain:	is_in_range_of:
has_DigitalObjectType	dopho:DigitalObject	controlled vocabulary in individuals: dictionary, edition, encyclopedia, image collection, sound collection, project documentation, conference web site, blog, podcast, journal, online journal tba.
has_Institution	dopho:DigitalObject dopho:OfflineProject	r3d:Institution
has_InstitutionName	r3d:Institution	r3d:InstitutionName
is_maintainedBy	dopho:DigitalObject	dopho:OfflineProject
has_OfflineProject	dopho:DigitalObject	dopho:OfflineProject
has_ResponsibilityType	r3d:Institution	r3d:ResponsibilityType
has_Creator	dopho:DigitalObject	datacite:Creator
has_Contributor	dopho:DigitalObject	datacite:Contributor
is_maintained_by	dopho:DigitalObject	dopho:OfflineProject
has_RepositoryIdentifier	dopho:DigitalObject	r3d:RepositoryIdentifier
has_RepositoryIdentifierType	r3d:RepositoryIdentifier	r3d:RepositoryIdentifierType
has_RepositoryIdentifierValue	r3d:RepositoryIdentifier	r3d:RepositoryIdentifierValue
has_RepositoryURL	dopho:DigitalObject	r3d:RepositoryURL
has_Subject	dopho:DigitalObject	r3d:Subject
has_SubjectScheme	r3d:Subject	r3d:SubjectScheme
has_SubjectName	r3d:Subject	r3d:SubjectName
has_ResourceType	dopho:DigitalObject	datacite:ResourceType
contains_ProjectDocumentation	datacite:ResourceType	dopho:ProjectDescription
contains_FactsRepository	datacite:ResourceType	dopho:FactsRepository
contains_CollaborationTool	datacite:ResourceType	dopho:CollaborationTool
has_Type	dopho:DigitalObject	controlled vocabulary in individuals:academic, governmental, popular science tba

Data properties:		
Name:	domain:	literal
has_thisRepositoryName	RepositoryName	Free text in xsd:string
has_thisStartDate	dopho:DigitalObject	yyyy-mm-dd, yyyy-mm, yyyy, in r3d:dateFormat
has_thisEndDate	dopho:DigitalObject	yyyy-mm-dd, yyyy-mm, yyyy, in r3d:dateFormat
has_thisUpdate	dopho:DigitalObject	yyyy-mm-dd, yyyy-mm, yyyy, in r3d:dateFormat
has_thisCloseDate	dopho:DigitalObject	yyyy-mm-dd, yyyy-mm, yyyy, in r3d:dateFormat
has_thisOfflineDate	dopho:DigitalObject	yyyy-mm-dd, yyyy-mm, yyyy, in r3d:dateFormat
has_thisInstitutionName	r3d:InstitutionName	free text (name of institution)/city/department (optional)/country (controlled vocabulary from ISO 3166-1 alpha-3) in xsd:string
has_thisCreator	datacite:Creator	free text (name of person, ORCID recommended) in xsd:string
has_thisContributor	datacite:Contributor	free text (name of person, ORCID recommended) in xsd:string
has_thisOfflineProjectName	dopho:OfflineProject	free text in xsd:string
has_thisRepositoryIdentifierType	r3d:RepositoryIdentifier	free text in xsd:string, DOI recommended
has_thisRepositoryIdentifierValue	r3d:RepositoryIdentifier	free text in xsd:string, DOI recommended
has_thisRights	datacite:Rights	free text in xsd:string, example: CC BY-SA
has_thisLanguage	r3d:Language	controlled vocabulary in xsd:language
has_thisSubjectName	r3d:SubjectScheme	InPho categories in xsd:string; additional other indication as: free text in xsd:string
has_thisRemarks	r3d:Remarks	free text in xsd:string
has_thisApi	r3d:Api	free text in xsd:string
dopho:thisContentVanishingPeriod	dopho:DigitalObject	yy/mm/dd after yy/mm/dd
dopho:EventTaking place	dopho:DigitalObject	yy/mm/dd

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Köln, den