Experiential Observations: an Ontology Pattern-based Study on Capturing the Potential Content within Evidences of Experiences

Alessio Antonini a,*, Alessandro Adamou b, Mari Carmen Suárez-Figueroa c, and Francesca Benatti d

a Knowledge Media Institute, The Open University, Milton Keynes, UK
E-mail: alessio.antonini@open.ac.uk

b Bibliotheca Hertziana, Max Planck Institute for Art History, Rome, Italy
E-mail: adamou@biblhertz.it

c Ontology Engineering Group (OEG), Universidad Politécnica de Madrid (UPM), Madrid, Spain
E-mail: mcsuarez@upm.es

d Department of English & Creative Writing, Faculty of Arts & Social Sciences, The Open University, Milton Keynes, UK
E-mail: francesca.benatti@open.ac.uk

Abstract. Modelling the knowledge behind human experiences is a complex process: it should take into account, among other characteristics, the activities performed, human observations, and the documentation of the evidence. To represent this type of knowledge in a declarative way means to support data interoperability in the context of cultural heritage artefacts, as linked datasets on experience documentation have started to appear. With this objective in mind, in this paper, we describe a study based on an Ontology Design Pattern for modelling experiences through observations, which are considered indirect evidence of a mental process (i.e., the experience). This pattern highlights the structural differences between types of experiential sources, such as diaries and social media contents, providing a guideline for the comparability between different domains and for supporting the construction of heterogeneous datasets based on an epistemic compatibility. We have performed not only a formal evaluation over the pattern, but also an assessment through a series of case studies. This approach includes a) the analysis of interoperability among two case studies (reading through social media and historical sources); b) the development of an ontology for collecting evidences of reading, which reuses the proposed pattern; and c) the inspection of experience in humanities datasets.

Keywords: Ontology engineering, Knowledge patterns, Digital Humanities, Intangible cultural heritage

1. Introduction

Although knowledge engineering for the Digital Humanities has gone a long way in the production of formal models for the representation of tangible elements of cultural heritage, recent research has attempted a systematic cataloguing, modelling and usage in content annotation of phenomenological entities that originate from the interaction with material content, yet are per se immaterial. Examples include the experience of reading a book, or of listening to someone read it aloud. In addressing the issue of capturing evidence of an experience through Linked Data, research projects such as the UK Reading Experience Database (RED) [1] and Listening Experience Database (LED) [2] have adopted different, arguably simplistic approaches at modelling an experience as a single entity – with LED representing it, for instance,
as an “internalised event”. This could be justified by the core use cases of these endeavours not requiring the identification of constituents (e.g. in textual evidence) beyond addressing factual elements such as what book was being read, who was playing the music being listened to, where and when.

The reality, however, is much more complex: the experiences associated with reading a book are decoupled from the activity of reading, or the event that this triggers in the material world, or the diary entry or letter that documents the whole. It may, however, be debated that, whilst not corresponding to the effect that such an activity has on one’s surroundings, an experience may go hand in hand with the epistemology of such effects [3]. Therefore, although modelling the experience as a single entity could be reductive in use cases such as fine-grained content annotation, it is also difficult to reach a consensus on how to model all kinds of experiences. It is however possible to identify recurring elements that may serve as ontological coordinates in the topology of an experience, which calls for an ontology design pattern (ODP).

In this paper we present an ODP called Experience & Observation (E&O) and study the potential impact of introducing it into existing and future Humanities data. E&O models the observation of experience as resulting from a direct engagement in an activity and reflected in an observation prompted from the person engaged in the activity. This is a content pattern (CP) whose core set of entities expand upon the concept of experience, which does not appear in the pattern itself in named form. Instead, E&O represents an experience through its factual, cognitive, phenomenological and critical coordinates, which all lend themselves to further specialisation in the ontologies where the CP will be instantiated, as well as to use cases like fine-grained text annotation.

1.1. Motivation and Aim

This pattern is motivated by the need, as appreciated from datasets such as the UK RED and LED, to express the relations between any type of source, its information content (the observation) and the activity in object, distinguishing between the potential content of observations included in, for instance, diaries and correspondence, authors’ libraries, social media or surveys.

A hypothetical upper ontology of observation would abstract from the phenomenon by providing a middleware between phenomenological ontologies and ontologies of sources (see Fig. 1). On the one hand, ontologies of sources, examples of which are FR-BRoo [4] and SPAR [5], describe objective features of sources, but not their information content. On the other hand, experiential ontologies describe the phenomenon in object, but not the relations between the content structures and features of the sources. In other words, the need for the E&O is grounded on the need for a language to express general features of sources with a direct relation with their phenomenological content – for example, where a listener recounts that a particularly “groovy” riff in a rock song, once carefully heard on earphones, inspired them to conduct research on the musicians that wrote and performed it.

The aim of the proposed pattern is to support data interoperability between research use cases, clarifying the relation between activity, reflection and the evidences used in experiential studies. Indeed, each different experiential study adopts different models for the description of data, grounded on the nature of the phenomenon in object and relying on a set of assumptions concerning the homogeneous nature of sources.

1.2. Application scenarios

The E&O pattern discussed in this contribution is intended to support the extensions of schemas and ontologies for encoding research data from experiential studies to express key facts concerning sources, which would otherwise be lost with the background knowledge of the experts on those sources. Indeed, interoperable research data introduce this new issue concerning the reuse of data thanks to a detachment between the analysis of sources and the use of the generated data, removing mastering the sources from the requirements for using the data. For instance, we can have a Classical Studies scholar comparing the reception of Roman texts based on marginalia in a Latin codex with so-
cial media from online reading platforms, without re-
quiring any understanding of, for example, the differ-
ences in reader profiles and reasons for reading classi-
cal literature. In other words, the technical feasibility
granted by a common schema does not extend to in-
formation essential to the correct framing of a study,
which lies mostly on background knowledge.

The rest of the paper is structured as follows. Sec-
tion 2 provides a brief background on experiential
studies and the issues concerning observing experi-
ence. Section 3 presents a summary of the state of the
art, including relevant patterns and experiential ontolo-
gies. Section 4 describes the E&O pattern in detail,
while Section 5 is devoted to its evaluation. In section
6, we discuss the application of the pattern and of the
retrospective case studies. Section 7 provides a discus-
sion of the case studies in terms of common patterns
emerging from applying E&O to the encoding of the
different types of sources. Finally, Section 8 concludes
the paper and includes future lines of work.

2. Background

The goal of the E&O ontology pattern is to support
interoperability across disciplines and projects sharing
a focus on human experience. Specifically, E&O ad-
dresses the interoperability of the sources of evidence
of experience. Indeed, a prior work on a reading expe-
rience ontology [3] is being implemented as a module
for the CIDOC-CRM ISO standard for Cultural Her-
tage2, providing a shared platform for reading and a
pattern for other forms of experience. However, having
a common ontology of experience is limited to sup-
porting the interoperability of research outputs (e.g.,
annotation of sources), while the interoperability of re-
search requires addressing sources as a key factor in
the design of a case study.

2.1. Research Interoperability

An example of this issue concerning heterogeneous
sources is given by the research programme of the EU
JPI for Cultural Heritage project Reading Europe Ad-

ance Data Investigation Tools (READ-IT), which in-
cludes a wide range of different case studies [6]. The
READ-IT case studies rely, in turn, on a wide range
of sources, such as interviews, school diaries, war di-
aries, letters, authors’ libraries, postcards, chat con-
sversations, forms, web scraping from online reading
platforms, paintings, pictures, online forms, docs, re-
views and social media comments. The READ-IT ap-
proach is based on data interoperability, i.e., the en-
coding of research outcomes in a common format, the
Reading Experience Ontology (REO), through the use
of a shared toolbox including an annotation tool, con-
tribution platform and machine-learning services for
text and image analysis.

At the same time, the sources used to generate these
data tell multiple stories. Indeed, sources of reading
experience are the result of different situations entail-
ing specific constraints on the type of research and
questions researchers can address. For instance, dif-
ferent sources hide different intrinsic characteristics of
the evidences of reading experience, such as a) the ma-
turity of reader’s reflection, b) the reader’s freedom of
expression or c) the purpose of their testimony of their
experience. Intuitively, the different underlying condi-
tions of sources entail a different set of ontological and
epistemic assumptions that are understood clearly by
the researchers working hands-on on the sources but
not reflected in the research data.

The data-driven approach to interoperability hides
two orders of issues (see Figure 2). Firstly, the reuse
of data implies a form of indirect reuse of sources
and therefore a question of integrability, i.e., which
facets of the phenomenon could be used to explore the
sources. Secondly, even though different sources could
be integrated, there is a question of compatibility be-
tween the reused source and the research framing of
the case study: for example, can the reused source be
employed to address the research questions of the case
study?

In the following section, we outline a parallel be-
tween the anatomy of reading and the generation of
evidences of experiences, as mirrors of facets of the
experiential phenomenon.

2.2. Anatomy and Evidence of Experience

The two issues of “integrability” and “compatibil-
ity” are critical, ultimately, because of the interference
of the observation on the phenomenon in object. In-
deed, the activity of generating an observation influ-
eses the phenomenon observed. Intuitively, human
experience is the result of reflection while, similarly,
the generation of an evidence requires also a reflection
on the reflection which can, for example, trigger a re-
vision, and therefore a change in the experience.

2Reading Experience Ontology and module for CIDOC-CRM on
GitHub https://github.com/eureadit/reading-experience-ontology
Fig. 2. Data interoperability enables the reuse of research outcomes through case studies, but hides an issue of "integrability" between sources and "compatibility" between a source being indirectly reused through research data within the framing of a new research study.

On the one hand, in the case of historical sources this interference is not controlled and therefore requires expertise to enable a retrospective analysis of the sources. On the other hand, in the case of sources generated within a research framework, the interference is designed with the aim of fostering the emergence of specific facts on the experiential phenomenon in the resulting evidences. For instance, structured interviews are designed to a) create a specific setting and b) support the emerging of specific information, regardless of the different participants engaged.

Both cases of controlled and non-controlled interference require a disentanglement of the relations between the cause of experience and the source, as the evidence of experience is one of many possible formulations of such experience (i.e., an observation) reporting some facets of the experience in object (i.e., the meaning of the observation), as in Figure 3. In this view, the formulation of these relations concerns specifically, a) the "mapping of meaning" between the experience encoded in an observation and the situation causing the experience, and b) the "mapping of condition" of the generation of the observation and the situation of the experience. These mappings represents the binding between the elements of the anatomy of experience and the structure / content of the source.

A good example of the mapping of condition concerns identifying the level of maturity of the experiences reported in the sources. For instance, a source used in one of the READ-IT case studies is a set of structured interviews asking about the life-time effect of reading. At close analysis, some of the transcripts include some temporal clues about the age of the person at the time of the interview or about the temporal distance between the interview and the reading. For the purpose of reusing data and sources, this information could and should describe the whole set of interviews and, by extensio, the dataset produced by the case study. This form of encoding would rely on knowledge of the source, e.g., from the interviewer or the researcher working on their annotation.

In this view, the following state of the art focuses on the approaches to provenance and observations adopted in the design of ontologies and patterns for experiential and observational studies in general.

3. State of the Art

Our analysis of the state of the art highlighted a small set of relevant works. This is not surprising as personal observations and experiences do concern forms of subjective interpretation on what is relevant, why, and how hard to model. From a broader perspective, the sources of evidence of experience are indeed widely addressed for their objective, material and factual properties. However, the scope of the standards for
sources, such as Prov-O\textsuperscript{3} (which focuses on the activities behind the generation of data) and CIDOC CRM\textsuperscript{4}, is limited by a focus on the artefact itself and its value for archival science or cultural heritage.

We therefore do not concern ourselves with a discussion of ontologies for sources and provenance, but focus on specific ontologies and design patterns about the observation of events. Part of the selection of relevant work involved searching the Linked Open Vocabularies registry\textsuperscript{5} (LOV) and the Ontology Design Pattern repository\textsuperscript{6} (ODP).

LOV indexes four ontologies about observation: ISO 19156 Observation Model; Observation Method Ontology; Sensor, Observation, Sample, and Actuator (SOSA) Ontology; OWL for Observations; all of the above relate to sensor observations. Upon searching LOV using Experience as a term, we found one related ontology: the Experience API (xAPI), which is primarily about games and the interaction activities of gamers with them, yet covers none of the arising subjective aspects.

ODP includes patterns concerning a) observation, b) activities, and c) transition. In the following sections, we discuss these patterns focusing on the interactions with E&O and on the opportunities for reuse.

Lastly, the research for relevant works was extended to ontologies, models and schemas developed within the frame of experiential studies. In this view, we considered the ontologies of the UK Reading Experience Database (RED), the Listening Experience Database (LED) and the Reading Europe Advanced Data Investigation Tool (READ-IT).

The rest of the section is dedicated to the discussion of the findings of the search for ontologies and patterns, the ontologies of experience developed in previous projects and an analysis of the gaps.

3.1. Observation Pattern

The Observation pattern, in describing “the observation of things, under a set of parameters”,\textsuperscript{7} assumes the possibility of a “direct” observation of material, visible objects. Conversely, E&O concerns indirect observations of mental events which cannot be measured but are instead evaluated through the mediation of the personal perspective of the person “owning” the experience and of the prompting activity from which the observation arises. This epistemic divergence prevents the reuse of the Observation pattern in the domain of experience.

3.2. Activity Specification Pattern

The Activity Specification pattern\textsuperscript{8} addresses the representation of activities and the observation of states as effects of activities. The pattern supports a parthood hierarchy (meronomy) of activities and also the temporal ordering of activities and states, identifying different roles of states as precondition or effects, terminal or non-terminal states. E&O reuses its Activity class, as it provides the necessary elements for representing temporal distance and significant events (as change of states) reflected within the observations.

3.3. Transition Pattern

The Transition pattern\textsuperscript{9} addresses transitions between states and is complementary to Activity Specification, adding to it the metaphysics of state transitions as caused by events, and the effect of changes on things. The E&O goal, on the other hand, is to describe the indirect study of an experience through the traces of its effect, i.e., the observations. In this view, an observation’s content concerns states as effects of a transition resulted from carrying out an activity, i.e., the agent’s engagement. The E&O concept of engagement could then be considered as a transition effect of an event activity and the cause of a state change in an agent involved in the activity. Since this does not supplement any concept required by E&O, Transition does not appear nor is subsumed in our CP.

3.4. News Reporting Event

The News Reporting Event ontology pattern\textsuperscript{10} addresses indirect observations, e.g., news reporting based on third party direct observations. In this view, the pattern enables an articulated description of the situ-

\textsuperscript{3}https://www.w3.org/TR/prov-o/
\textsuperscript{4}http://www.cidoc-crm.org/
\textsuperscript{5}https://lov.linkeddata.es/
\textsuperscript{6}http://ontologydesignpatterns.org
\textsuperscript{7}http://ontologydesignpatterns.org/wiki/Submissions:Observation
\textsuperscript{8}http://ontologydesignpatterns.org/wiki/Submissions:ActivitySpecification
\textsuperscript{9}http://ontologydesignpatterns.org/wiki/Submissions:Transition
\textsuperscript{10}http://ontologydesignpatterns.org/wiki/Submissions:NewsReportingEvent
uation of the event and its direct observation and the relation with the report and reporter. Interestingly, this pattern introduces a secondary indirect source in the observer as grounding the report, defining an epistemic chain between report end event through two agents: the observer and the reporter.

3.5. Social Reality

The Social Reality ontology pattern\(^{11}\) implements Searle’s theory about social reality. In The Construction of Social Reality [7], Searle addresses the tension between the objectivity of social reality and the subjectivity of its interpretation by defining a scoping rule: X acts as Y in C. This rule frames the objectivity of social facts within a specific social context (e.g., an organization) in which their meaning, as social/institutional artefacts, has a value of fact. In this view, this pattern supports a form of subjectivity in the relation between “brute” facts and the plurality of contexts of interpretation.

3.6. Evidences of Experience

Unlike external observations, human experience can be observed only through the lenses of the human involved in the experience. Thus, experiences are reported indirectly, reflected in a wide range of sources. The sources of evidence of experience (evidences) can be more or less structured in how they present human observations. For instance, a conversation could include cues about experience blending within other topics. Another form of evidence could instead be a rating from one to five collected right after an activity (e.g. after a call). In the field of the Humanities, the most common evidences considered are cultural heritage artefacts, such as the personal correspondence of authors or authors’ libraries including notes and marginalia, but also paintings of experiences, poetry and other aesthetic expressions. In this view, there is a partial overlap between the description of cultural heritage artefacts, e.g. their provenance and content, and the description of the experiences included. In this view, it is worthwhile considering three research projects addressing the experiences of reading and listening. Indeed, these projects have faced the challenge of extending and complementing the description of cultural heritage supporting the analysis of evidences under the light of aesthetic experience.

In the following section, we provide a brief introduction to these projects and discuss their approaches to the description of human experience.

The UK Reading Experience Database (RED) is a Digital Humanities project created over twenty years ago that collects and annotates evidences of reading from cultural heritage sources, such as correspondence, diaries and reports. These sources are being curated by scholars, students and volunteers, building an unprecedented and rich dataset. This is accessible through its portal\(^{12}\) and as Linked Data\(^{13}\). The EU-funded JPI for Cultural Heritage “Reading Europe Advance Data Investigation Tool” project (READ-IT) builds from the experience of RED, increasing the scope from the UK to Europe, and extending the conceptualisation of experience.

The Listening Experience Database (LED) addresses the experience of music and performances. Differently from RED and READ-IT, LED uses digital archival resources to identify and reconstruct evidences of listening experiences to be further analysed by researchers.

3.6.1. RED

RED uses cultural heritage sources of different types. These sources were collected during multiple campaigns by scholars in the project and by students. The provenance of sources is therefore heterogeneous, however all the sources are text-based. From these sources, annotators identified and annotated the fragments of text relative to reading, extracting information about the reader, the content and the conditions of reading.

In its last iteration, RED recognises both reading and listening experiences. In RED an experience is described by an evidence (i.e., a fragment of text) and contextual information about reading: where, when, who and how, which takes the shape of properties like century, country, reader, time, place, type of experience (i.e., reading or listening) and conditions (e.g., aloud, silent). Regarding sources, RED uses a bibliographical approach including, e.g., reference, author and editor. Of interest are the additional notes, often including key information about the source of relevance for the researcher, such as:

\(^{11}\)http://ontologydesignpatterns.org/wiki/Submissions:Social_Reality_%28OWL_2%29

\(^{12}\)http://www.open.ac.uk/Arts/reading/UK/index.php

\(^{13}\)RDF graph at http://data.open.ac.uk/context/red
“Letter (original in Polish) from Conrad to Aniela Zagorska, Pent Farm, [ ] Christmas 1898” - from RED, resource 32273\textsuperscript{14}.

These extra notes help researchers in understanding the kind of content they could find in the evidence, such as the fact that Conrad’s letter was written to his niece and who translated it from Polish.

3.6.2. LED

LED integrates different digital archives to reconstruct musical performances, events, performers and listeners. By relying on archival data, LED includes information about the provenance of sources. Furthermore, the LED schema provides a rich description of the cooperative annotation work and, therefore, of the provenance of the data extracted from the evidences of musical experience.

The LED ontology connects the notions of Listening Experience, Source, Agent and Music. In LED, listening experiences are described by reusing the concept of event from existing ontology literature. Regarding sources, LED reuses and extends the Bibo ontology\textsuperscript{15} with a vocabulary of types of sources, such as oral history or official documents.

3.6.3. READ-IT

READ-IT extends the RED approach to contemporary sources and to multiple languages. Like RED, READ-IT includes a wide range of sources, not limited to cultural heritage but also including web-scrappings from reading websites, interviews, social media, and crowdsourced testimonies.

Along with a standalone version, the READ-IT ontology REO was also re-implemented for the CIDOC Conceptual Reference Model (CRM) ecosystem\textsuperscript{16}, the ISO standard for cultural heritage archives. In this view, READ-IT reuses the CIDOC CRM core for describing the content of sources and a new set of concepts concerning the reader’s “state of mind” and the condition of reading. The READ-IT data model is agnostic to sources. Indeed, READ-IT does not provide a specific solution but relies on domain-specific schemas and ontologies, e.g., FRBR\textsuperscript{17} for library resources, CIDOC-CRM for cultural heritage and Schema.org\textsuperscript{18} for web sources.

3.7. Direct, Indirect and Experiential Observations

The overview of patterns and ontologies concerning experience, activities and observation highlights an integration gap. Indeed, by considering the different patterns and ontologies, we can see how different aspects of the problem in hand can be addressed by reusing existing definitions.

Firstly, both activities, source of experience and the relation between evidence and activities can be described by reusing e.g. Schema.org and REO.

For instance, in terms of Schema.org, a “CreativeWork” can be used to represent the evidence of experience (e.g. a review blog post), that is “about” an “Event” source of experience (e.g. a concert), with the “creator” of the “CreativeWork” be an “attendee” to the “Event”. Then, the specific aspects of the experience reported in the “CreativeWork” can be described by the REO concepts of “State of Mind”, e.g., encoding an emotional response.

From this view, the gap is not technical or in the lack of vocabulary, but concerns the definition of a common approach bridging different experiential domains that is independent from a specific ontology or schema.

Furthermore, there is a second gap concerning the ontological differences between external observation and internal observation. As highlighted in the discussion of the Observation pattern, the description of an external direct observation concerns the measure of events. Similarly, the patterns News Reporting Event and Social Reality address a different form of external observation. In the first case, it can be traced to a direct observation (“ActualEventView”) or, in the second case, to the observation of “BF” (brute facts) as being relative or representative of social/institutional facts in a given context. All of these approaches address the objectivity of observation as either being material (direct observation), epistemic (report) or context-related (social structures).

By contrast, an aesthetic experience is legitimately subjective. Indeed, the human agent subject to an experience is both the object of change (the experience) and the subject observing the experience. In this regard, we can strive to provide an objective description of the possible changes triggered by an experience, e.g., as

\textsuperscript{14}https://www.open.ac.uk/Arts/reading/UK/record_details.php? id=32273
\textsuperscript{15}https://bibliontology.com/
\textsuperscript{16}http://www.cidoc-crm.org/
\textsuperscript{17}https://www.ifla.org/publications/functional-requirements-for-bibliographic-records
\textsuperscript{18}https://schema.org/
attempted with REO. However, which changes occur and how these changes are being investigated is, for now, an intimate process that cannot be observed, but only reconstructed as a teleological explanation by the subject of the experience itself. In this view, the activity of reconstructing the experience is of great relevance in guiding the explanation (e.g., in focus, length and results).

The importance of prompting (see Figure 4) is not new in psychology and social studies. In these fields, the problem concerns achieving a specific predictable response (e.g., during therapy or large-scale studies). However, the problem in our case is the opposite: reconstructing what the effects of the prompting could have been in the reporting of experience, through a variety of heterogeneous settings.

Though indirectly, human experience can be observed through the testimonies of people. The development of an experience is the result of the direct engagement within an activity. The engagement is significant, i.e., leading to an experience, when results in a transition of mental state, such as the emergence of an emotion, the acquisition of an important memory or the learning of something new.

Experiential observation is intangible and unique but the conditions of how we extract and report our experience are recurrent. Researchers can develop a broad understanding of the different settings, if provided with the specific necessary information. The scope of this contribution lies in defining what these information are beyond the specific domain.

4. Experience & Observation Pattern

The rationale behind the E&O pattern is that an experience is too phenomenologically complex to be ontologically captured as a single entity in a satisfactory manner. This, combined with the emergence of multiple datasets that offer examples of domain-specific kinds of experience as Linked Open Data, determine the need for a content pattern. This complexity is also the reason why a named experience class is not to be found in this CP: the activities of interaction and consumption, an individual’s engagement in them, their reflection upon it and the critique formulated over such reflection are all coordinates of an experience as a phenomenon. However, as mentioned earlier, trying to pinpoint it by capturing it as a single named entity risks being too reductive an exercise.

From a pragmatic perspective, consider an example use case of text annotation: given a text excerpt (e.g., a letter or diary entry), an annotator has the opportunity to highlight passages describing the author’s conscious effort in capturing the setting, its artifacts, the activity of interacting with it, the resulting states of mind or changes to them, and to assign a typed entity to each. The experience per se can be seen as being evidenced by the excerpt as a whole.

The E&O pattern focuses on the engagement in an activity, and on the creation of an observation as a result of another activity that prompts it (see Fig. 5). As such, it is predicated on the following competency questions [8] (CQs):

CQ1. In what ways can one person be engaged in each activity?

CQ2. What personal observations were produced by reflecting upon an activity being carried out?

CQ3. Which activities performed by someone have prompted an observation from that person and which have not?

The E&O pattern is composed of the entities shown in Fig. 5, and which are detailed in the sections to follow.

4.1. Fragment about Activity

class Activity. An occurrence being led by an active - though not necessarily conscious - agent. We accept the notion of activity as defined in the content pattern Activity Specification [9], due to its flexible relationship to events and its ability to capture states and the transitions of which they are extremes.

4.2. Fragment about Engagement

class Engagement. This class is the core type of entities that represent a reification of one’s involvement in an activity. If, for example, the participant’s reason for their interaction was to write a review for a magazine, this will be encoded in instances of this class. While one could directly connect a person or agent to the activity itself, as already allowed by the participant properties of Activity Specification, reifying it here (using the n-ary relation logical pattern) becomes a necessity, as the participant’s reflection upon the activity itself (e.g. “The concert would have sounded better if I had picked one spot and stayed there all the time, instead of moving around”) typically differs from the reflection on their engagement with it (e.g. “The sound came out more powerful than I had expected when listening to their live recordings at home”).

property isEngagedIn. Connects the participant being engaged in an activity with the engagement itself. We assume Person from the seminal CP Persons to denote the domain of this property with sufficient generality.

property inActivity and its inverse property hasEngagement. Connects an activity with the many possible ways to engage it. Note that neither this property nor isEngagedIn are functional: this is intentional, as an individual may in fact be engaged with an activity in a multitude of ways. For example, a critical engagement may arise from the fact that the subject attended a concert because they were being paid to write a review, whilst an emotional engagement may coexist with it, if the performers also happened to be the writer’s favourite artists.

4.3. Fragment about Observation

class Observation. An engagement, depending on whether it is emotional, critical or of another nature, is a cognitive process which may or may not generate conscious output, which is represented by this type. Note that different engagements give rise to potentially different observations, hence the further need for n-ary relations as explained above. For the purpose of the pattern definition, we do not provide here a vocabulary of the various types of engagement: the place for this is the ontology where this CP will be instantiated.

property isReflectionOn and its inverse property isReflectedUponIn. A two-way connection between an engagement and the observation it contributes to, if any. Once again, the properties in this inverse pair are not functional: one observation may be the collective outcome of multiple engagements (for example, both the emotional and critical engagements may end up being documented in the same written review) and one engagement may give rise to multiple observations (documented, for example, in tweets) at separate times.

property producedObservation. This property can be used as a shortcut to denote that something is (even indirectly, not necessarily through direct reflection) responsible for the existence of an observation. The following property chain is encoded in this CP for the case of activities.

\[
\text{hasEngagement} \circ \text{isReflectedUponIn} \sqsubseteq \text{producedObservation}
\]

4.4. Fragment about Prompting

class Prompting. Not every activity is expected to give rise to an observation if, for example, the engagement in it was not a conscious one: those that do may be specially labelled as prompting [activities], in order to be set apart from the others. This is a defined class whose defining axiom is specified as follows:
Prompting ≡ Activity \[\exists \text{producedObservation.Observation}\]

This property includes. This property is used to establish a mereological, parthood-based structure within an activity, which can then be seen as composed not only of sub-activities (as mandated by the Activity Specification CP), but also of observations. We use a bespoke property here, not lifted from other content patterns, to denote that it does not necessarily define containment in the spatial-temporal “topology” of an activity, since observations can result from an ex-post reflection as well.

4.5. E&O Pattern Implementation

The E&O pattern was implemented in the OWL language using such tools as Protégé [10] for development and Ontoology [11] for debugging. The code of its RDF serialisation is available on GitHub.22 In addition, the documentation of the E&O pattern is available as a Content Pattern submission to the Ontology Design Pattern portal.23 From an OWL 2 logical profile standpoint, this implementation of E&O falls within the OWL 2 RL tractable fragment: its use of inverse object properties rules out OWL 2 EL, whereas the use of property chain axioms rules out OWL 2 QL.24

5. E&O Pattern Evaluation

While evaluating an ontology design pattern shares some methodological elements with the evaluations of ontologies tout-court, the associated quality criteria and evaluation framework lie on even less trodden ground than ontology evaluation itself. This section, and the one that follows, document the efforts undertaken to reach an evaluation as complete and as close to the few existing frameworks as possible, and their results.

5.1. Methodology

In his doctoral thesis, Hammar distills a set of quality characteristics from the existing literature on ontology patterns, which are intended for use as evaluation criteria. These are grouped under the macro-categories of functional suitability, usability, maintainability and compatibility, for the details of all of which we refer to [12]. All the functional suitability criteria, which concern the ability of the ODP to meet its own stated needs, pertain to the ontology as a standalone artifact and can therefore be validated as such (cf. Sec. 5.2). Usability refers to the ODP as a combination of the ontology and its documentation (cf. Sec. 5.3). Finally, most aspects pertaining to maintainability and compatibility concern applications and relationships of the pattern with the other models in the Web of Data, and will primarily be covered in Section 6.

5.2. Functional Suitability Evaluation

Whether the E&O pattern satisfies functional suitability criteria can be assessed through engineering mechanisms associated to self-testing the pattern if treated as an ontology.

One such criterion is functional completeness, i.e., the degree to which the ODP meets its modelling requirements, which were defined in Section 4 as competency questions. It is customary, in this sense, to reformulate these as queries in the SPARQL language: the results of this conversion are shown in listings 1-3.

In what follows, the default prefix is assumed to be mapped to the namespace http://modellingdh.github.io/ont/odp/term/, whereas the activity specification pattern namespace is http://ontology.eil.utoronto.ca/icity/ActivitySpecification/.

CQ1. In what ways can one person be engaged in each activity?

```
SELECT DISTINCT ?engagement
WHERE {
  ?who :isEngagedIn ?engagement .
  ?engagement :inActivity ?activity
}
```

Listing 1: SPARQL query for CQ1

It should be noted here, that using individuals of type Engagement to represent the different “ways of engaging” as expressed in CQ1 comes at no loss of...
expressivity, as the distinguishing features of an engagement vary depending on the experiential domains at hand. E&O itself is not concerned with modelling these features; however, examples of these are present in the legacy datasets described in Section 6.3 and offer useful insights as to how such “ways” could be modelled.

CQ2. What personal observations were produced by reflecting upon an activity being carried out?

```
SELECT DISTINCT ?observation
WHERE {
  ?observation a :Observation
}
```

Listing 2: SPARQL query for CQ2

CQ3. Which activities performed by someone have prompted an observation from that person and which have not?

```
SELECT DISTINCT ?activity
WHERE {
  { ?activity a :Prompting }
  UNION {
    ?activity a activity:Activity ; :producedObservation []
  }
}
```

Listing 3: SPARQL query for CQ3

The query for CQ3 covers the explicit case where activities are typed as Prompting, as well as a second case where a more generic type expression statement allows promptings to be inferred by means of their ability to produce observations. Activities that satisfy neither condition will not be present in the result set.

We also note that these queries contain property paths of length no greater than 2 – as is the case of those for CQs 1 and 2 – and otherwise make use of commonplace coverage strageties such as UNION (CQ 3), thus attesting to the functional appropriateness of E&O.

Another criterion for verifying functional suitability is Consistency [12]. This criterion is ensured by the fact that, although all the classes explicitly defined in the pattern are disjoint, no equivalence or multiple subsumption occurs between them. This was confirmed by a run of the HermiT 1.4 reasoner.

Lastly, as there is no established modelling standard for experiential data, the accuracy [12] of this content pattern cannot be assessed, other than by demonstrating its ability to represent the domain modelled by existing datasets, which will be covered in Section 6.3.

5.3. Usability Evaluation

It is also crucial to evaluate an ODP with respect to its usability in specific scenarios. This usability dimension implies six quality characteristics [12]. From these we consider in this section a) appropriateness recognisability, that is, whether an ontology developer is able to recognise the pattern as a suitable pattern for her objective, and b) user interface aesthetics, which refers to how appealing the ODP documentation is. Both quality characteristics refers to intuitiveness.

In order to evaluate the usability of the E&O Pattern, we conducted a user experiment involving Master students at Universidad Politécnica de Madrid (UPM)25. Students, working in groups of 4 or 5 members, had to reuse the E&O Pattern (among other ontological resources) in the development of an ontology network that describes a particular domain. Students had the freedom to select among the following domains: Webcomics, Resonance in collective reading, School diaries, The places where we read, Correspondences, and ‘Stalking’ on social media. After developing the ontology, students had to fill a questionnaire that included, among others, questions regarding the reuse activity. Those questions were created with the goal of gathering information about the following usability indicators [12]: accompanying text description, documentation completeness, structure illustration, and usage example count.

After analysing students’ responses, on the one hand we can conclude that the intuitiveness of the E&O Pattern needs to be improve since only 34.5% of the students considered the pattern as an intuitive ODP. In this sense, students reported a) incomplete documentation (detailed descriptions of pattern elements are missing) and b) lack of examples of use. As an illustration of point a), students were confused about the meaning of class Prompting and the meaning of the rela-

25Details about this user experiment are available at https://doi.org/10.21954/ou.rd.14156624
6. Applications

Beyond the formal validity, the E&O has been assessed through a case study-based approach.

The pattern was developed within the scope of READ-IT, though not as part of it. The READ-IT project provided the motivation for the development of E&O and the opportunity to identify a gap in the description of evidences of reading. It allowed the evaluation of E&O in addressing an open challenge concerning the interoperability of research case studies and the interoperability of heterogeneous sources of evidence of reading collected through a multi-modal, multi-lingual contribution ecosystem.

Outside the scope of READ-IT, E&O was applied in a retrospective analysis to data of legacy DH project28. RED and LED. The aim of this retrospective analysis is to support the reuse of their data and therefore to renew their value within the context of new edge research programmes. This retrospective analysis was carried out on the "UK Reading Experience Database" (RED) and the "Listening Experience Database" (LED).

26For doing these tools such as LODE (https://essepunatato.it/ lode/) and Widoco (http://dgarijo.github.io/Widoco/) can be used.
27E&O documentation https://modellingdh.github.io/odp_
experience/
28Legacy DH project in terms of the end of the research projects and investment on data modelling and curation.
6.1. Interoperability of Research Case Studies

READ-IT is a multidisciplinary project aiming to develop a toolbox for investigating the different facets of reading. The motivation of building common tools is twofold. Firstly, the toolbox aims to converge research data through the adoption of the same data models across the tools. Secondly, the adoption of common data models aims to support a cross-disciplinary reuse of data among research case studies, i.e., an interoperability of research work on data and sources.

In this view, READ-IT produced an ontology of reading experience (REO) used in annotation tools and algorithms, which supports the interoperability of research data in terms of annotation on evidences of reading experience (sources). At the same time, there is still a gap in the description of sources from the perspective of the experiential studies, i.e., not of the content of sources or provenance but of the contextual information necessary for their correct interpretation.

Indeed, the reuse of research data requires an understanding of the research activities in terms of analysis of evidences of reading. In this regard, the underlying assumptions of the research case studies are explainable in terms of constraints on the available sources, specifically when concerning cultural heritage.

For example, a reception study of a nineteenth-century author would focus on the analysis of the correspondence of the author, reporting setbacks with editors and comments of other fellow authors. Differently, a reception study today would be grounded on a more systematic analysis of book sales, critics and interviews of readers. The key difference between historical and contemporary reception studies is in the availability of sources and therefore in the constraints that must be considered in their interpretative analysis. In the first case, the nature of sources, professional correspondence among authors and editors, is considered as a filter applied to the reported experiences. Thus, the expert on the source would consider specific linguistic cues and habits to the code of the underlying message. Differently, contemporary digital reading platforms would provide explicit reference to reading experience from a variety of different readers.

These differences can be grasped and considered in the design of research case studies when working directly with sources, while data about the reading experience may hide these differences.

In this case study, we used E&O as a common format for the description of the different sources of evidences of reading, identifying the qualitative differences between case studies in terms of source constraints.

The researchers involved in the project provided a general classification of case studies [6]: 1) reading through social media, 2) self-reflection, 3) places where we read, and 4) historical sources. This classification expresses a form of comparability, or similarity, among cases studies that cannot be reduced to features of sources, period, contents or readers. Using E&O, we revisit two of the categories, reading through social media and historical sources, under the light of structural differences between case studies.

6.1.1. Reading Through Social Media

The new practices of reading through social media re-frame reading as an active form of social engagement, thus configuring practices of collective reading. A study analyses the “tsukkomi”, humorous comments placed by readers directly on comic canvases [13] and the webcomic author-readers sections [14]. This category concerns the reading experiences of two different types of reader:

1. Passive readers exposed to comments from other readers
2. Active readers engaged in online discussions

Passive readers are those whose reading activity includes being exposed to other readers’ observations and, therefore, to an experience mediated by comments, votes, sponsorships and other types of social media feedback surrounding the content. The others are the active readers, for whom the social engagement, like engaging in discussions with other readers after each issue, is part of the experience. Thus, the prompting activity leading to the observation must be considered as part of the reading activity.

![Fig. 6. A passive reader r1 is engaged in an activity a1 which includes an observation o1; the activity a1 and included observation o1 are reflected in the observation o2 created through prompting p1.](image)

These two categories differ on the relation between activity and prompting. In Fig. 6, the observation included in the activity is not the result of the activity itself. In Fig. 7, the observation is created within the frame of the activity, through a sub-activity prompt-
6.1.2. Historical Sources

In the READ-IT project, an important set of sources include nineteenth- and twentieth-century letters, diaries and libraries (annotated books) of famous authors [15]. These sources provide different types of experiences concerning different types of prompting and timings of the observations. Indeed, the experiences reported in diaries and letters are the result of matured reflections, whereas book notes (marginalia) are mostly first impressions and emotional reactions jotted down while reading. In this view, the information content of the experiences included in the marginal notes are nowhere similar to diaries and correspondence and should be considered akin to social media.

Unlike modern-day messaging, authors’ letters were carefully polished observations of artistic and scholarly value. This activity was part of the authors’ work in which they invested a relevant part of their time and which could have a huge impact on their career and opportunities. Similarly, diaries contained personal notes about the creative process, inspirations and ideas sourced from readings and personal experiences. The main difference between letters and diaries concerns the time-frame for reflections. As today, diaries were used to keep track of daily events through fast-paced observations, while the interval between letters could be of weeks or months through slow-paced or matured observations.

The differences between fast-paced or matured observation is represented by either implicit or explicit temporal relations between the two, i.e., through dates or temporal ordering (see in Fig. 8).

6.2. Collecting Evidences of Reading

Part of the READ-IT toolbox is a multi-modal, multi-lingual contribution platform. This platform is used to collect evidences of reading experience during engagement events, conferences and workshops, from reading groups or scholars and from project followers. Data collection includes the use of physical postcards, online forms, uploaded documents or pictures, web-scraped data and conversations with chatbots, in the different languages supported by the project.

The contribution platform is a proactive tool for data collection. The collection is structured into campaigns aiming to collect specific types of evidences. In this regard, the collected evidences should include a description of the aims of the campaign, as well as the constraints related to the specific modality adopted.

The contribution platform is used to build a common set of evidences of sources available to the project network of researchers. In this regard, the collected sources should be described by considering, as for the
Fig. 10. TellMeWhatUReadingbot, the English version of READ-IT chatbots on Telegram, https://t.me/TellMeWhatUReadingbot.

Example 1. Postcards (see Fig. 9) distributed during dissemination events including a question (similar to the chatbot), an empty box for writing a reply and a QR code linking to the contribution platform for scan and upload. Filling postcards during events is a collective activity that does not allow much time for reflection.

Example 2. The READ-IT chatbot @TellMeWhatUReadingbot (see Fig. 10) guides users through targeted questions, e.g. “what are you reading today and why?” The chatbot uses a starting question – a particular prompting – but then engages the user using a set of follow-up prompts to extend their contributions. A chatbot conversation can take hours and is an intimate activity.

Both postcards and chatbot use a similar set of questions and generate anonymous data. Thus, in terms of tasks and expected content, they are almost identical but the condition in which the observation is generated is different as are the audience and modalities of engagement. In the first case, the chatbot gives time to reflect and does not expose readers to external judgement. Differently, during events the audience is mostly composed of scholars and enthusiasts dedicating a few minutes of their time to fill the cards while chatting e.g. during a coffee break.

In this case study, we used the E&O pattern as base of a specific “Crowdsourcing of Evidences Ontology” (CEO) used for describing the sources collected from the different streams funneled within the READ-IT contribution portal (see Figure 11).

Fig. 11. CEO is based on the ontology for crowd-sourcing management[16], describing tasks, management and results of crowd-sourcing campaigns.

In CEO, the E&O is applied on the ontology for crowd-sourcing management [16] making explicit the nature of, for instance, crowdsourcing activities and tasks as prompting "producesObservation", i.e. the resources collected from the crowd (see Figure 12).

Considering Examples 1 and 2, CEO is used to describe the two engagement settings, similarities between the tasks, language and the duration of campaigns (e.g., two/three-day events or a long-term campaign through the project website embedding the chatbot).

https://github.com/eureadit/crowdsourcing-ontology
6.3. Experience in Legacy Humanities Datasets

Regardless of the actual “age” of a Digital Humanities project, there are several ways in which the assets produced by it may become obsolete. Firstly, a successful project addresses its own research questions, exhausting the value of data through the publication of results in more accessible forms of knowledge, such as articles and books. Secondly, the morphology (schema, format etc.) of the data is usually designed to support the addressing of those specific research questions. Though the data may still be open for reuse, without further investments their accessibility and practical value may be diminished by the fact that they were not designed with enough flexibility to lend themselves to future research questions. This issue concerns, for instance, the use of “ad hoc” project terminology that is related to edge research and therefore to hypothesis rather than consolidated knowledge, which is the focus of the research agenda.

In this view, a common problem of legacy DH is reconciling data with schemas and structures that in time have become mainstream thanks to, for example, the emergence of Wikidata and authority files, or new extensions to CIDOC-CRM. At the same time, while contextual information may have been encoded by using standard ontologies, the core research concepts may escape the scope of standards for several years or decades. In this regard, a possible approach would involve the development of research-oriented upper ontologies with an orthogonal focus on research design instead of the object of the research.

In this scenario, E&O provides an agnostic description of experiential studies that can be retrospectively applied to legacy DH, regardless of reaching a consensus on how to define potentially controversial concepts about human experience.

We therefore approached RED and LED as legacy DH projects in a retrospective application of E&O, with the aim of breaking out of the silos between research topics (experience of music and experience of reading), thus enabling reuse of the data beyond the contextual information (e.g., people, locations, time of experience). The datasets of these projects, though both available in RDF format and with references to external entities, are modelled in ways that reflect the research interests of project leaders and Humanists in the respective research groups, rather than their own intrinsic potential for future study.

Two main differences are worth highlighting between RED and LED. Firstly, they both focus on aesthetic experiences that profoundly differ in the way they are triggered and engaged in: RED focuses on reading, an experience which requires an active and conscious effort of the reader in engaging with a medium and text, e.g. book, which is mostly individual. Differently, LED focuses on the experience of music such as concerts, opera or recordings, which are frequently collective experiences and more prone to occur incidentally or unintentionally.

A second key difference concerns the type of sources and their content. RED is based on “traditional” literature sources that mostly report on self-reflections on reading. These sources present little contextual information as to the when, where and how of reading, focusing on their understanding and opinions on contents. Differently, the value of LED is in the use of “non-traditional” sources and the use of Semantic Web technologies to integrate and expose several archival data as one research repository of listening experiences, combining, for example, records of events, locations, artists, performances and participants.

RED data do not present the same level of detail as READ-IT, but could theoretically be updated with a re-curation effort. However, the new curation process would have to rely on the reuse of RED data as sources for new case studies, thus the need for exploring RED from the perspective of identifying, among the different sources, the ones compatible with a given research design, i.e., aims, methods and tools. Similarly, LED data concentrate more on documenting the experience than on describing it and, while some parameters such as simple condition descriptors (e.g., whether it was public, indoor, performed live or in playback) are present, drawing a more richly structured context.
would require a re-curation effort over the textual evidence.

To demonstrate the suitability of a flexible representational model for experiences as is the E&O pattern, one should lift the schemas of both these legacy datasets so that they can be represented in terms of this pattern. Since pattern-based ontology methodologies recommend that published modules implement content patterns, rather than being the patterns themselves [17], the RED and LED models were aligned to an ontology that implements E&O, as well as to each other. The implementation in question is the previously described CEO ontology (cf. Sec. 6.2).

Fig. 13. Alignments between an E&O implementation in the Crowdsourcing of Evidences ontology and legacy DH project ontologies.

CEO redefines the classes and properties that constitute E&O (including those from the Activity Specification pattern) in its own namespace and is isomorphic with E&O, in that it preserves the morphology that emerges from class definitions, subsumption axioms and property domains and ranges. The alignments of CEO with each project ontology were performed in separate modules, both of which are available as code repositories on GitHub. Alignments were performed using standard techniques of adding subsumption and equivalence axioms, or subsuming class restrictions that further refine property domains and ranges [18]. The process has resulted in the mappings described below.

As previously discussed, E&O does not offer a standalone concept as a synthesis of the experience. Classes so named, however, exist in both the RED and LED ontologies: in both cases, they are primarily modelled as events, following the specification of the Linked Open Description of Events [19] and the event model present in the Music Ontology [20], respectively. Both projects also offer specialisations of this Experience concept, centered on the listener (both in RED and LED, as listening to someone read aloud is contemplated as an experience in its own right) or on the reader (applicable to RED only). As this level of detail escapes the remit of CEO, it was seen fit to map these specialised concepts directly to each other.

Fig. 14. Mappings of the various Experience classes in RED and LED to each other and to CEO and REO.

Figure 14 offers a summary of how the classes labelled Experience in the legacy datasets are aligned within the CEO-RED-LED environment. We observed that, in the RED data, red:Experience is used as a non-discriming concept that encompasses the practical activity of reading as much as the resulting observations that are reported in the evidence as outcomes of the activity: no distinction between such activities and events is offered by the data. red:Experience also incorporates indicators of the subject’s state of mind (e.g. whether the listener is being reactive), or of their engagement (e.g. whether solitary or in the company of others). However, as the concepts of activity, engagement and observation are disjoint in E&O, and by extension in CEO, the mapping to red:Experience had to be asserted as an OWL disjoint union, in or-

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30RED alignments, https://github.com/modellingDH/UK-RED.
31LED alignments, https://github.com/modellingDH/LED.
order to reflect the manifold nature of this class whilst preserving logical consistency. This is an example of the side effects of modelling experiences in an overly synthetic way, as stated at the beginning of this paper. Other alignments were carried out between the subsuming class red:Experience_Reader and concepts specific to reading due to being defined in REO: these include the reading process, its outcomes and resulting states of mind, again mapped to RED via a disjoint union.

The LED data model, on the other hand, separates the competences of the Experience event from those of the event that denotes the sound performance. The latter can be as simple as the playback of a record album and constitutes at least one of the activities that prompt the observation. For that reason, led:Experience subsumes ceo:Engagement, rather than ceo:Observation, yet its “listening variant” links to the latter by means of a ceo:includes relationship of at least one ceo:Observation produced by a musical performance, which we have materialised as AuralObservation for convenience. It follows that, whenever a mo:Performance (from the Music Ontology) gives rise to an observation, it is also a ceo:Prompting, another class derived from E&O. This is not optimal, as we have discussed in Section 4 that promptings are likely to be activities where the subject participates actively, rather than the performances themselves: the mapping covers cases where the experience is entirely incidental, or where the experiencing one is a performer, but for most other cases additional activities should be materialised, which are not made explicit in LED.

No other suitable mappings to the concept of prompting were found among the terms explicitly defined in either model, thus reflecting the fact that neither project had in its research interests to systematically study the stimuli and motivations that give rise to experiences. To that effect, it should be borne in mind that it was in the mandates of both projects that they should exclude any professional or otherwise solicited reviews as acceptable source material, which naturally limited the scope of prompting.

Similarly to the previous case study, E&O is used to describe the different types of evidence of experience. The application of E&O works as an upper ontology between two very different datasets, regardless of their discussed differences. This enables orthogonal queries on, for example, which activities are collective or individual, or on the timing of evidence collection.

7. Recurring Configurations

The use of E&O in the four case studies highlighted nine recurring configurations, which are themselves knowledge patterns orthogonal to the types of study. Indeed, the possible configurations of activity, reflection and observation are bound by a limited number of permutations in general and by more specifically a limited number of realistic opportunities to collect observations. Interestingly, these patterns identify an alternative classification system relating evidences otherwise considered distant from or incompatible with the perspective of the focus of the relative case studies. In the following section, we describe nine patterns aggregated by considering the different configurations concerning prompting, engagement and process of reflection.

7.1. Prompting

In regard to prompting, the possible configurations concern the proximity between activity and observation (see Fig. 15): the temporal distance between activity and observation, i.e., timing of prompting, and the interrelation between activity and observation, i.e., the context of prompting.

Figure 15: The possible configurations of prompting concern the temporal distance and interrelation between observation and activity.

Fig. 16: prompting distant from the activity. Observation and activity are distant in terms of time and absence of interrelation. The distance allows room for reflection and a clear distinction between the outcomes of the activity and the experience (outcome of the reflection).

Example 1. A study of the formative influence of reading during significant life events, such as conflict or migration, collected years or decades later in struc-
tured oral history interviews. One example is the work of the Reading Communities project [21].

Figure 17: prompting during the activity. Observation and activity co-occur in the same temporal interval (overlap). The overlap allows only a partial acquisition of input from the activity and resulting reflection, influencing the content of the observation.

Example 2. A study of comments and social media reactions to YouTube videos concerning, for instance, conspiracy theories [22].

Figure 18: prompting as a part of the activity. The creation of an observation is a component of the activity (inclusion). The temporal overlap is also combined with an interrelation between the activity and the prompting of the observation such that the creation of an observation is a task of the activity.

Example 3. A study of “marginalia”, notes written by authors in their books to prepare future writings. The marginalia are written as part of the reading activity, e.g., for the sake and as reference to future works [23].

Figure 19: prompting right after the activity. The prompting of the observation is so close to the completion of the activity that can be considered subsequent. The short or non-existent gap between activity and observation results in collecting a first impression (or response) to the activity.

Example 4. Study on social media engagement features such as “follow” and “like” buttons placed at the end of issues of webcomics. Readers are nudged to express their approval and willingness to continue reading by using these functionalities, often by other readers reminding them to “like” or to “subscribe” to show support for the author. See for example the “Smash that like button” prompt at the end of Rachel Smythe’s Lore Olympus n.151 [32].

7.2. Engagement

The conditions of engagement within the activity contribute to the acquisition of the inputs for the reflection, and therefore to the experience reflected in the observation. In this view, the completion of an activity or the exposure to other observations as part of the activity result in different types of input.

Figure 20: interrupted Activity. An activity is interrupted before its completion and therefore the information considered for the creation of the observation is just partial. In this case, the completion of the activity is delayed or unplanned, leading to a reflection based on few elements of the activity and on a guess of its outcomes.

Example 5. In 1797, poet Samuel Taylor Coleridge had a powerful vision. He began to write the poem “Kubla Khan” to record his observations of this activity, but was interrupted after 55 lines by an unnamed

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"person from Porlock" and never completed the poem [24].

Figure 21: socially mediated experience. The engagement in an activity includes the exposure to third-party observations about the activity. In this scenario, the weighting of the activity factors considered and the outcomes of the experience are suggested by the activity simulating in the person a form of (positive or negative) prejudice based on prior experiences. The reflection then takes into account the direct experience (engagement in the activity) and indirect experience reported in the third-party observations.

Example 6. Reading the classics of literature in an edition that includes reviews from literary critics. According to Italo Calvino, when new readers approach a classic of literature, their reading is filtered through the interpretations of previous readers and through the influence of that classic on subsequent texts [25].

7.3. Reflection

The multiplication of activities, observations and subjects involved configure different types of reflections, leading to revision, comparison, cumulative effects and negotiation of the experience.

Figure 22: revision of the experience. The reflection on an activity lasts for a period of time giving the opportunity to generate several observations at different points in time. The multiple observations could be contradictory or address different aspects of the activity, highlighting the evolution of the reflection.

Example 7. A study of a diary or letters reporting the experience of reading a serial text, e.g., published weekly or monthly. The observations are created after reading increasingly greater amounts of text. See for example The Guardian’s online reading group on Charles Dickens’s Bleak House, which read the book over several weeks [26].

Figure 23: collective experience. The reflection is part of a collective activity involving several people and therefore visible and exposed to a public. The scope and aim of a reflection is influenced by being either in an intimate setting or subject to public evaluation and, therefore, affecting the content of the observation.

Example 8. Social reading practices, such as face-to-face reading groups. The presence of other people influences how readers react and express their observations, e.g., exploring association between location, devices and conditions [27].

Figure 24: cumulative experience. The reflection concerns a series of activities: as a result, an observation combines elements of the experience of different activities. In this scenario, the experiences of different activities are interwoven and described by comparison, distinction and difference among each other.
Example 9. A study of the influence of different authors carried out on the correspondence and diaries of influential scholars. See for example 19th-century Italian poet Giacomo Leopardi assessing the influence of reading several authors, including Petrarch and Germaine de Staël, on his own style.

8. Discussion and Conclusions

In section 6, we presented four direct applications of E&O to support the comparability of research case studies and, consequently, the potential interoperability of research activities on evidences of experience. The value of E&O is grounded on the limits of focusing exclusively on the content of evidences, decoded and annotated through research activities, while overlooking the background knowledge on the context of sources. In this regard, E&O provides a language to define the features of experiential studies on the assessment of the “potential information content” of sources, described in terms of the articulation of observation, activity and prompting.

E&O enables the documentation of the dynamics of activity and observation, thus complementing research data. This new form of description sheds new light on the differences between evidences and therefore on the constraints to research design. It is useful, for instance, in identifying compatible sources and defining new comparative studies reusing data. An emblematic example is the comparability between author’s annotations in books and social media comments, in terms of the timing of prompting and the embedding of observations in the reading. This new perspective provided by E&O opens new scenarios for the reuse of research data through a data-driven definition of multi-source datasets, for instance about emotional responses in inclusive and passive readers, a measure would consider the ratio between the number of observations generated by the reader vs. the observations the reader is being exposed to (i.e., comments created vs. comments visible in the appendix). As a further example, the difference in the maturity of the observation (e.g., between fast-paced and slow-paced observations) could be measured as a time difference, considering the interval between the creation of the observation and the time of the activity.

The case of the READ-IT project is somehow unique. Indeed, READ-IT contains several sub-projects and therefore can directly benefit from E&O for the reconciliation of its internal activities and from a measure of comparability across datasets. On the same line, the retrospective analysis of legacy DH projects, RED and LED, exemplified how this perspective could be applied to “restore” legacy data back to the edge of research [28].

The adoption of the E&O can support breaking domain silos beyond the scope of academic research. This is achieved by providing means for an epistemic comparability of study designs, i.e., the settings of experiential data collection. In this view, the presented applications focused on observation of aesthetic experiences in the context of academic research, but we do not see a reason for limiting the scope of E&O. More broadly, experiential studies are of great relevance in Human-Computer Interaction (HCI), Computer Supported Cooperative Work (CSCW) but also in management and professional fields of user experience (UX), interaction design (ID) and Information System (IS), e.g. in usability studies. At the core of E&O is the necessity to provide an epistemic-focused description, alternative or complementary to an ontological description of evidences of experience. Indeed, sharing an ontological view of a phenomenon does translate into compatibility of results and alignment between different approaches to knowledge acquisition. In other words, the focus of the alignment should not be limited to defining the facets of the experience, but on how these facets emerge, i.e., experiences become visible.

In this contribution, we presented the issue and a solution in the E&O pattern. We used four applications to demonstrate the need and value of the proposed approach, solving both practical issues concerning multidisciplinary research and revitalizing legacy data. The discussed applications were used to evaluate the pattern (within the framework of the READ-IT project) and validate it (in external projects LED and RED).

E&O is also being tested by independent groups applying E&O to real-life experiential studies. Lastly, we presented nine recurring design patterns highlighting unexpected association between otherwise unrelated sources.

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33See Leopardi’s Zibaldone, 28 November 1821 http://digitalzibaldone.net/entry?id=1255.
The limitations of the presented work concern the narrow scope of the application to the research domain and aesthetic experience. Future works should focus on applying E&O to professional applications and to management, social science and design fields, such as, HCI, IS, UX, ID and CSCW.

This work makes evident the need to further investigate and describe the relation between observations in hard and social science, with phenomenological observations. On this note, a priority is the reconciliation of the E&O with the Observation pattern, addressing the epistemic differences between a direct and an indirect observation, e.g., between a physical event and a mental one.

Finally, in the field of the Semantic Web, future work should tackle the focus of models, in terms of being description of epistemic or ontological aspects of a phenomenon, i.e., how to know or what there is to know, providing a language for the relations between the two perspectives.

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References


The Uses of Literature.

