Towards the Ontologization of the Outsider Art Domain: Position Paper

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Abstract

The purpose of this paper is to present a prospective and interdisciplinary research project seeking to ontologize knowledge of the domain of Outsider Art, that is, the art created outside the boundaries of official culture. The goal is to combine ontology engineering methodologies to develop a knowledge base which i) examines the relation between social exclusion and cultural productions, ii) standardizes the terminology of Outsider Art and iii) enables semantic interoperability between cultural metadata relevant to Outsider Art. The Outsider Art ontology will integrate some existing ontologies and terminologies, such as the CIDOC - Conceptual Reference Model (CRM), the Art & Architecture Thesaurus and the Getty Union List of Artist Names, among other resources. Natural Language Processing and Machine Learning techniques will be fundamental instruments for knowledge acquisition and elicitation. NLP techniques will be used to annotate bibliographies of relevant outsider artists and descriptions of outsider artworks with linguistic information. ML techniques will be used to acquire knowledge from linguistic features embedded in both types of texts.

Keywords: ontology engineering, cultural heritage, outsider art

1. Introduction

Culture, creativity and inclusive society are widely represented in the innovation agenda for cultural heritage in Europe. Since 2014, almost €5 billion was invested in cultural and cultural heritage projects under the European Regional Development Fund (Europa Nostra, 2018). Between 2014 and 2019, €495 million was invested in Horizon 2020 in cultural heritage R&I (Zygierewicz, 2019). Despite this large investment, some socio-cultural groups are still not sufficiently integrated in cultural heritage experiences, as is the case of outsider artists.

"Outsiders" are highly innovative artists that have been aesthetically and socially marginalized because of their status as psychiatric patients, homeless, recluses, disabled persons, migrants and ethnic minorities. As a consequence, Outsider Art (Cardinal, 1972) is a nebulous domain and a deeply problematic notion. The concept remains the subject of highly diverse debates as to its meaning and scope (Philby, 2011). Today a plethora of sometimes misleading terms are used to describe it: art brut, art of madmen, art singulier, autistic art, (contemporary) folk art, (faux) naïve art, fresh invention, grass-roots art, intuitive art, marginal art, mediumistic art, neuve invention, non-traditional folk art, primitive art, primitivism, pseudo-naïve art, psychopathologic art, psychotic art, raw art, self-taught art, vernacular art and visionary art. Indeed, there are those who believe that Ousider Art is a tenable concept and those who question the authenticity of the concept. For example, Marcus Davies (2007) states that the use of the term is here to stay and James Elkins (2006) says that the term is an oxymoron and, consequently, there is no such thing as Outsider Art. This evidence leads us to conclude that there is a need to perform an explicit terminological standardization of the Outsider Art domain.

We propose an inherently interdisciplinary research project that explores the links between art and society by applying Natural Language Processing (NLP) and Machine Learning (ML) techniques. Specifically, we aim to represent part of the existing knowledge about so-called Outsider Art in a machine-readable language (ontology) that allows us to deduce implicit knowledge from the existing literature on Outsider Art. The Ontology will be suitable for discovering implicit facts, relations, and contradictions by using reasoning engines. In this sense, the ontology will help to provide a better understanding of the relation between social exclusion and artistic innovation by assigning meaning to huge amounts of textual data. Our main research objectives are:

- To examine the relation between social exclusion and cultural productions by applying an interdisciplinary approach that brings together technology, art and language.
- To standardize the terminology of Outsider Art by formally conceptualizing the domain using a combination of traditional ontology engineering and corpus based techniques, in particular NLP methods for (semi)automatic ontology learning and population (Maynard, Bontcheva and Augenstein, 2016).
- To enable semantic interoperability between heterogeneous metadata by coding textual information in a machine processable format with the goal of facilitating the development of emerging technologies for European smart museums, such as virtual assistants, recommenders, dynamic tourist guides and interactive exhibits.

2. Methodology, Tools and Resources

The Outsider Art ontology will be built using Ontology Engineering methodologies. There are well-established methodologies to support the process of ontology development and maintenance: e.g. An & Park's (2018) methodology, POEM (Ali and Khusro, 2016), Bautista-Zambrana's methodology (Bautista-Zambrana, 2015), NeOn (Suarez-Figueroa et al., 2012) and DiDOn (Keet, 2012).

As can be seen in Figure 1, ontology authors vary significantly in their approach to developing their respective ontologies. The Figure 1 below shows 28 methodologies and 15 activities that are frequently used in the development of ontologies. The light-shaded green boxes are the activities that occur in the early stage of the

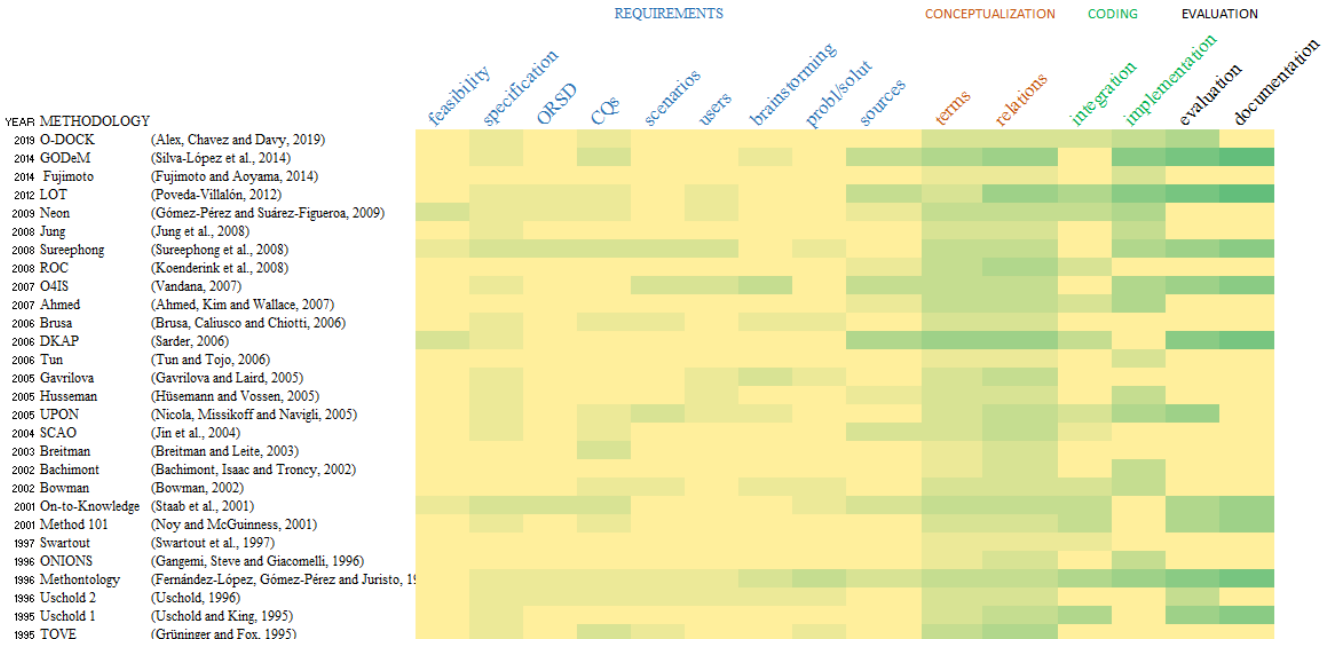

Figure 1: Ontology Engineering: methodologies and activities.

ontologization process, while the dark-shaded green boxes represent the later activities. Those activities can be arranged in four processes: requirements, conceptualization, coding and evaluation. For example, the O-DOCK methodology (Alex, Chavez and Davy, 2019) contains: 1) a very early stage for requirement analysis based on competency questions (CQs) followed by 2) a stage for the extraction of terms and relevant relationship definition (conceptualization), 3) the translation of concepts and relations into a computer-readable language, including the integration of existing ontologies (coding) and 4) a final stage for error detection (evaluation).

Our approach for Outsider Art ontology development will consider the most prevalent stages of the most outstanding methodologies for ontology engineering, as detailed below.

2.1 Specification: Requirements and Sources

The specification is a process that will be used for identifying, among other things, the purpose, scope, feasibility, intended users and requirements of the Outsider Art ontology. From among all of the existing specification techniques, we will employ competency questions (CQs), the analysis of domain specific text corpora and an online form to capture the ontology specifications. This information will be included in the so-called Ontology Requirements Specification Document (ORSD).

Competency questions is a list of questions that the Ontology of the Outsider Art should respond to correctly. Two examples of competency question are: "*What diseases/disabilities do the outsider artists suffer from?*" and "*What themes do the outsider artists paint?*" From such competency questions, a number of seed concepts will be drawn up: e.g. "bipolar disorder", "Alzheimers", "multiple sclerosis", "autism", "alcoholism", "flowers", "birds", "violence" and "sex".

In order to build an ontology for terminological purposes, it will be necessary to collect a large text corpus. In this respect, the quality of the corpus will be one of the parameters to be taken into account when we devise the Outsider Art ontology. This is particularly important for ontology learning from texts since NLP techniques depend on corpus quality. For this reason, the source text that we will use for Outsider Art ontology learning should be well-balanced and representative, i.e., a body of scientific books, papers, magazines and web pages. We will focus on two types of texts or discursive genres: bibliographies of relevant outsider artists (see Table 1 (a)) and descriptions of outsider artworks (see Table 1 (b)).

Table 1. Two types of texts in the field of Outsider Art.

(a)	Wölfli was born in Bern, Switzerland. He was abused both physically and sexually as a child, and was orphaned at the age of 10. He thereafter grew up in a series of state-run foster homes. He worked as a Verdingbub (indentured child labourer) and briefly joined the army… (Wikipedia).
(b)	André Masson, *Labyrinth*, 1938. Influenced by Freud, Masson's work represents an attempt to gain access to unconscious thought through automatic techniques. Starting with a web of rapidly formed lines… (Rhodes, 2000, p. 117) (see Figure 2).

Additionally, in order to collect ontology requirements, an online survey will be distributed among specialists in Outsider Art at different institutions across the world, e.g. Museu d'Art Brut[1] (Barcelona), Collection de l'Art Brut[2] (Switzerland), Outsider Art Fair[3] (Paris), Raw Vision Magazine[4], etc.

Figure 2: André Masson, *Labyrinth*, 1938.

2.2 Conceptualization: NLP & ML Techniques

The conceptualization stage consists of representing knowledge about the Outsider Art in a semi-formal format (i.e. in an artificial and formally defined language) using NLP and ML techniques.

The Outsider Art corpus will be normalized and annotated using linguistic pre-processing techniques (Maynard, Bontcheva and Augenstein, 2016) such as sentence splitting, tokenisation, part-of-speech (POS) tagger, chunk parsing, name entity recognition and classification (NERC) and co-reference resolution. There are many tools available for NLP in many platforms: Natural Language Toolkit[5], Stanford CoreNLP[6], Freeling[7], Ixa Pipes[8], and OpenNLP[9]. Last but not least, the General Architecture for Text Engineering (GATE) (Cunningham, et al., 2002) is a popular NLP toolkit with support for ontology based IE and ontology learning.

The supervised learning techniques will be employed to make use of the latent features embedded in the bibliographies of relevant outsider artists (see Table 1 (a)) and descriptions of outsider artworks (see Table 1 (b)) to acquire knowledge with very limited human intervention. For example, the identification of terms that are relevant to the Outsider Art domain will be done by using distributional knowledge (Doing-Harris, Livnat and Meystre, 2015) and contextual knowledge (Hoxha, Jiang and Weng, 2016) coming from syntactic and semantic annotation of texts. Semantic Similarity between labelled words or phrases (Liu, Li and Deng, 2017) will be applied to find additional mentions of an ontology class such as the painter's "subject matter" based on lexico-syntactic information described in Table 2.

Table 2. Information format for the class *subject matter*.

NP (as Subject)	VP (as verb)	COMPLEMENT (as object)
His work	Ranges	from idyllic scenes…
Dellschau's work	Shows	the influence of…
Hampton	Described	his work as a monument to Jesus…
The subjects of his work	Included	waterfront landscapes,…

2.3 Coding: the Web Ontology Language

Another of the key decisions to take in the Outsider Art ontology development process is the selection of the appropriate ontology language for modelling, encoding and querying the target domain. The Resource Description Framework or RDF (Schreiber and Raimond, 2014) is a language for representing binary relations between two resources on the Web. The two resources (subject and object) and the relation (predicate) form a triple: e.g. `Picasso → was-born-in → Spain`. The Web Ontology Language or OWL (Hitzler et al., 2012) is a language for making ontological statements whose syntax and formal semantics are derived from description logics. A number of query languages have been developed to extract information from RDF and OWL, including SPARQL (Pérez, Arenas and Gutierrez, 2006) for RDF and SQWRL (O'Connor and Das, 2009) for OWL.

2.4 Evaluation approaches

The Outsider Art ontology will be evaluated by comparing the learned ontology with the content of a text corpus (corpus-based approach) (Rospocher et al., 2012) and by measuring how efficiently the ontology is for the automatic classification of text documents (task-based approach) (Pittet and Barthélémy, 2015).

Additionally, a semi-automatic approach will be applied using the CQchecker (Bezerra and Freitas, 2017; Bezerra, Freitas, and Santana da Silva, 2013), an algorithm that verifies whether the ontology answers CQs at the terminological level. The CQchecker splits a CQ expressed in natural language into tokens and tries to find the concepts and relations from the ontology described in OWL DL[10] that the CQ referred to.

3. Source Integration Method

It is a fact that most ontologies for Cultural Heritage are interdisciplinary artefacts since they describe objective manifestations of the human mind, including customs,

[1] https://www.museuartbrut.com/fons-dart.html
[2] https://www.artbrut.ch/
[3] https://www.outsiderartfair.com/
[4] https://rawvision.com/
[5] https://www.nltk.org/
[6] https://stanfordnlp.github.io/CoreNLP/
[7] http://nlp.lsi.upc.edu/freeling/node/1
[8] http://ixa2.si.ehu.es/ixa-pipes/
[9] https://opennlp.apache.org/

[10] OWL DL is a rich ontology language that supports high expressiveness and decidable reasoning.

practices, places, objects, artistic expressions and values. For that reason, building ontologies from scratch is often not a viable alternative as recent works proves.

For example, the Conservation Reasoning ontology (CORE) (Moraitou and Kavakli, 2018) extends our information about artworks from the CIDOC CRM ontology by adding knowledge about materials, chemical properties, polymers and measurement techniques based on the empirical analysis of resources such as vocabularies, thesaurus, wikis and other ontologies. In Moraitou, Aliprantis and Caridakis (2018), the CORE ontology is merged with the Semantic Sensor Network ontology (SSN) in order to create a new ontology that expresses preventive conservation guidelines and rules based on sensor data about the artworks' environmental conditions. Similarly, the Heritage Building ontology (HB) (Tibaut et al., 2018), which represents knowledge about problematic issues with historical buildings, was created by integrating related domain ontologies (e.g. building materials and structures) and non-directly related domain ontologies (e.g. time, locations and persons). The Built Cultural Heritage ontology (BCH) (Zalamea, Van Orshoven, and Steenberghen, 2018) for the preventive conservation of architectural heritage was refined by merging Geneva CityGML and Mondis ontologies. Thus, the Mondis ontology provides classes for "Risk" and "Vulnerability" and the Geneva CityGML ontology provides classes to represent buildings, geographic areas and cities.

As shown in Table 3, the existing literature on Outsider Art describes both aesthetic entities (e.g. "Jean Dubuffet", "Hayward Gallery", "fantastical botanical images") and social/medical issues (e.g. "dental technician", "military officer", "depression", "mental pain") surrounding this form of art, in addition to non-specialized knowledge (e.g. "London", "1948").

Table 3. Different entities within the Outsider Art domain (some of them are highlighted in **bold**).

As a young girl, Anna Zemánková (Czech, 1908-1986), enjoyed drawing, yet gave up the hobby to pursue a career as a **dental technician**. She married a **military officer** and in **1948**, she moved to **Prague**, where she devoted all of her time to raising her family. Later in life, she struggled with **depression**, but found an outlet for her **mental pain** in art. At the crack of dawn, she would paint in a trance-like state, therapeutically creating **fantastical botanical images** from her imagination. Her series of surreal flowers was executed in paint, as well as in crocheted tissue paper. Her work is included by **Jean Dubuffet** in the Collection de l'Art Brut and was presented at the **1979** exhibition of Outsider art at the **Hayward Gallery** in **London**.

Thus, in order to categorise aesthetical objects, we can integrate several external resources including:

- The Conceptual Reference Model (CIDOC CRM) (Le Boeuf et al., 2019) is an extensible ontology that provides definitions and a formal structure for describing the concepts and relationships used in cultural heritage documentation.
- The Europeana Data Model (EDM) (Europeana, 2017) is an ontology-based framework that is suitable for the description of cultural objects.
- The Art & Architecture Thesaurus (Alexiev et al., 2017) is a thesaurus containing generic terms, dates, relationships, sources, and notes for work types, roles, materials, styles, cultures, techniques, and other concepts related to art.
- The Cultural Objects Name Authority (CONA) (Harpring, 2019) compiles titles/names and other metadata for works of art.
- The Getty Iconography Authority (AI) (Harpring, 2019b) is a thesaurus that covers topics relevant to art.
- The Getty Thesaurus of Geographic Names (TGN) (Harpring, 2019c) focuses on places relevant to art.
- The Getty Union List of Artist Names (ULAN) (Harpring, 2019d) is a structured vocabulary, including names and biographies of the people involved in the creation and study of art (see Figure 3).

There are a number of existing ontologies and terminologies that we can use to categorize social and medical concepts in the Outsider Art ontology:

- The UNESCO Thesaurus (UNESCO, 2019) is a controlled and structured list of terms in the fields of education, culture, natural sciences, social and human sciences, communication and information.
- The Human Disease Ontology (Schriml et al., 2018) provides the biomedical community with consistent, reusable and sustainable descriptions of human disease terms.

Figure 3: Example of search term in the ULAN (Harpring, 2019d).

On the other hand, the description of general knowledge, such as time and location, can be handled using specific and generic tools. Time Ontology (W3C 2017) and CRMgeo (Hiebel, Doerr and Eide, 2016) are examples of specific tools. The Time Ontology provides vocabulary for expressing information about relations between instants and intervals, durations and temporal position, including date-time information. CRMgeo is a geospatial ontology for cultural heritage documentation which has been integrated with GeoSPARQL vocabulary to categorize spatio-temporal classes and properties such as "Prague" or "London". Generic semantic resources include the Dbpedia and Schema.org. Dbpedia (Auer, 2007) is a knowledge base that stores structured data extracted from Wikipedia (3.64 million items organised in

320 classes and 1,650 different properties). Schema.org is a shared vocabulary to structure metadata models for around 614 different types of content, such as Creative works, Event and Place.

4. Current state of the research

Purpose, scope, feasibility, intended users and other general requirements of the Outsider Art ontology have been identified. We are currently working on collecting and labelling the Outsider Art corpus. In order to guarantee the quality of the data, we are compiling a short but highly normalized version of the corpus by hand. In addition to syntactic information, this corpus will be enriched with semantic information by using the resources described in Section 3. For example, by mapping the concept "Jean Dubuffet" in the corpus in ULAN vocabulary (RDF version), we are able to discover that: *(i)* the full name of this outsider artist was "Jean Philippe Arthur Dubuffet", *(ii)* "Louis-Léon Forget" was his pseudonym and *(iii)* he had a professional relationship with the painter Asger Jorn (see Table 4).

Table 4. Snippet of the ULAN vocabulary in RDF version.

<bibo:locator>(**Jean Philippe Arthur Dubuffet**; born 31 July 1901; died 12 May 1985; French painter and sculptor)</bibo:locator>
<bibo:locator>t.p. (**Louis-Léon Forget**) p. 8 (pseudonym of Jean Dubuffet, Forget is the name of his grand-mother)</bibo:locator>
<dc:description>Dubuffet, Jean (500019113) 'collaborated with' **Jorn, Asger** (500007669);</dc:description>

This enriched version of the corpus will be used to train a machine learning model for automatically classifying new texts about Outsider Art. That is because it has been proved that training corpora in conjunction with deep learning methods outperforms classical techniques for feature extraction and the classification of text, particularly on imbalanced datasets (Chen, McKeever and Delany, 2018).

5. Conclusions

We aim to develop the first ontology of Outsider Art. This is an innovative research project that focuses on three axes that have a significant impact on social diversity[11], the standardization of knowledge and the semantic interoperability of cultural data.

On the technical level, the Outsider Art ontology will contribute to the deployment of digital technologies for virtual and smart museums (e.g. concept/ aspect based opinion mining and opinionated semantic search tools, virtual assistants, dynamic tourist guides, interactive exhibits and chatbots) by standardizing data and knowledge about Outsider Art. In fact, the cultural sector is characterized by a complex data integration problem for which a solution is being sought through the development of metadata standards. Ontologies have found fertile ground in the cultural heritage domain due to the need to preserve, conserve, curate, and disseminate physical and digital objects.

The final ontology will be distributed online in a findable, accessible, interoperable and reusable format based on W3C standards: OWL, RDF and SQWRL. The Outsider Art ontology will be integrated into the Europeana Data Model and be mapped to Schema.org

[11] There is no doubt that the preservation and dissemination of non-traditional cultural heritage is necessary for a better understanding of cultural and social diversity.

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