CHAPTER 9

Discussion and conclusions

This thesis explored the benefits of computational methods for the representation, retrieval, and analysis of iconography and iconology information in the context of the semantic web. Due to the lack of data and representation means for formally describing the topics of the domain, the research aimed primarily at furnishing reusable tools for iconographical and iconological statement description and a domain-specific authoritative dataset. Furthermore, the study aimed to demonstrate the usefulness of conducting quantitative research. These objectives were expressed in two main questions, focusing on 1) the provision of ontological modeling for fostering access, retrieval, and analysis of iconological interpretations and 2) assessing the advantages of browsing and quantitatively analyzing a semantic network of iconographical and iconological interpretations.

The adopted methodology included a preliminary study of the domain on which the modeling of a new ontology was based. A selection of statements from the art historian Panofsky, chosen as a case study, was described accordingly. The data analysis was then conducted based on domain-specific research questions. Further quantitative inquiries into the art historian's method and iconological approach were performed. The ontology and dataset were evaluated according to quality metrics and compliance with FAIR principles.

The purpose of this chapter is to discuss the results of the research and draw conclusions. We provide an overview of the contribution of the work to the research objectives. We further discuss the key findings of the analysis conducted. Next, we highlight the impact of the research on the field of Digital Art History. Finally, we illustrate the limitations of the work, conclusions, and future work.

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9.1 Research objectives and contributions

The major contribution of the current work is threefold, as it responds to the needs raised by the defined research objectives. The main research contributions to each research objective may be illustrated as follows.

- **RO1: Providing reusable means for iconography and iconology formal description**. The objective was addressed by developing the domain-specific ICON ontology for the description of artistic interpretations, which allows a thorough illustration of artworks' iconographical-iconological subjects and meanings
- **RO2: providing a semantic dataset of domain-specific art interpretations**. The creation of the Iconology Dataset contributes to this objective, an RDF dataset of authoritative iconographical-iconological art interpretations of the art historian Erwin Panofsky in a structured format
- **RO3: addressing domain research questions in a quantitative way to prove the usefulness of the approach for iconographical-iconological inquiries**. A data analysis of the Iconology Dataset was performed. In detail, domain-specific research questions were quantitatively addressed, and new inquiries into the iconological method were performed

In the following sections, we provide an overview of the characteristics of each contribution and the key findings of the quantitative analysis.

9.1.1 Ontological modeling

In this thesis, we modeled ICON, an ontology dedicated to conceptualizing artistic interpretations designed by formalizing the content of several interpretation theories.[1] In line with the principles of reuse and interoperability of the Semantic Web, the ontology reuses (directly and indirectly) several existing ontologies. It is released alongside documentation that guides potential users in formalizing art interpretations using our model. ICON was evaluated for its extraction potential, syntax, metadata, and FAIRness. Moreover, its granularity was highlighted by comparing it with current ontologies on their respective serialization of the same interpretation. The results show how our work elevates the potential of expression of artistic interpretations in the context of the Semantic Web by providing a granularity level not reached by other ontologies on this topic. Finally, its effectiveness in describing the Iconographical and Iconological complex domain is confirmed by the results of the proposed competency questions, formalized in SPARQL queries, run on a test dataset containing artistic interpretations.

1 The results of the ontology modeling section were already published in Sartini et al. (2023), of which we report the relative text in this section.

9.1.2 Iconology Dataset

A core part of the doctoral project centered on the collection and the description of a selection of authoritative art interpretations by the art historian Erwin Panofsky. The work resulted in a Linked Open Data dataset containing interpretations mainly by the art historian about ca. 400 artworks, mostly from Middle Ages and Renaissance Western art. The dataset is modeled according to the newly created ICON ontology. Following the good practice of reuse, we used standards and available ontologies to describe cultural objects' metadata, citations, and people's roles. The interpretations are divided into three levels, from a more superficial understanding to a deeper one, as described by the art historian's theory, and inter-level links among identified subjects are provided. The subject types recorded include natural elements, actions, and emotions (level 1), characters, events, places, objects with a specific identity (e.g., the Bible), personifications, symbols, stories, and allegories (level 2), concepts, and cultural phenomena (level 3). For each subject identification, a provenance of the assertion is provided, indicating the author, source, and, eventually, the cited evidence. The dataset was tested according to the intrinsic, contextual, representational, and accessibility quality aspects by reusing available metrics in the literature, performing a high overall score (84%). Further quality evaluations included 1) compliance with ontology constraints through SCHACL shapes and 2) a self-assessment questionnaire to verify the adherence to the FAIR principles. The capability of addressing domain-specific research questions was evaluated by calculating the percentage of the 20 sub-research domain questions formulated in the analysis that were entirely (85%) or partially (15%) addressed.

9.1.3 Data Analysis and key findings

The data analysis over the Iconology Dataset was divided into two parts. First, domain-specific research questions identified during the domain study were specified into 20 sub-questions performed over the dataset. Secondly, new inquiries into Panofsky's approach and the iconological method were conducted.

9.1.3.1 Domain-specific Research questions

It was possible to address all the sub-questions formulated for each research question despite part of them not having enough ground, due to the lack of data in our dataset. This result seems to confirm that the modeling adopted is feasible to address a good amount of domain-dependent research questions quantitatively.

The domain-specific analysis showed some key findings:

- **Recognitions of cultural phenomena are poorly supported by textual evidence and the description at other levels**. There is a poor correlation between types of cultural phenomenon and subjects at previous levels (SQ2, SQ4). Unexpectedly, the recognition of cultural phenomena is the least supported by textual sources (SQ3). On the contrary, they seem more supported

by the relation with other artworks (SQ3) and tight relations with visual motif recognitions and other cultural phenomena recognitions (SQ5). Furthermore, when a visual subject of the artwork is indicated as particularly relevant to the cultural phenomenon recognized, first-level subjects prevail over second-level ones. This aspect may quantitatively show the method of the historian, who pays particular attention to the details, or quantitatively support the necessity of examining preiconographical details stated by Warburg.

- **When a textual source is cited, the symbol often presents a symbolical meaning different from the one it has when no evidence is provided**. The analysis carried out in SQ10 only interested nine results, of which five correspond to this trend. For the limited number of examined items, the results are not generalizable. Nevertheless, such insight shows that it is possible to detect the (supposed) influence of a specific source on the traditional meaning of a symbol.

- **Scholars tend to explain Renaissance artworks with a more significant number of textual evidence, and in particular Classical sources, compared with the Medieval period**. Although both periods are well represented in the dataset, only about ten textual sources are cited as evidence of artworks before 1400 (SQ18).

Generally, all questions showed the usefulness of the provision of data as an access point to specific information, foreseeing the potential that structured data can have to support thorough qualitative analyses.

9.1.3.2 Quantitative art historiography: characterizing Panofsky's approach

RQ4.1a asks whether we can quantify Panofsky's approach from his own interpretations.[2] The following sections focus on specific aspects of the investigation: textual sources, levels of interpretation of artwork, and iconological complexity.

The usage of text sources. The deep reliance on texts proper of Panofsky's method, often criticized by other scholars, seems not to be confirmed by data, as only 27% of the interpretations cite evidence, showing only 42 texts cited.

As expected, the higher number of recognitions are of iconological nature (the third level). However, unlike Panofsky's official claim, the type of evidence mostly cited to support such recognitions is artworks and not texts. Moreover, the number of textual sources cited to support iconological recognitions is smaller than the number of those cited to support pre and iconographical recognitions. It should be noted that the high amount of cited artworks is also due to some modeling decisions of complex cultural phenomena. Indeed, our modeling strategy consists of recording which artworks are labeled as being part of the same cultural phenomenon when the recognition of a

2 This section was published in Baroncini, Daquino, and Tomasi (2023a).

phenomenon in a certain artwork is also the reason why the same phenomenon is identified in another artwork. To this extent, this result would require further studies. From this first preliminary analysis, data seem to contradict the criticism raised against him by scholars who claimed that he was relying too much on texts when making considerations of iconological nature. Nevertheless, a comparison of the results with other art historians' practices would be needed to fully understand the frequency of textual citation among the community. Therefore, these results must be interpreted with caution.

Description at multiple levels. Interestingly, unexpected results were obtained by analyzing Panofsky's method. Although Panofsky insists on the subdivision in levels of the interpretation act, it seems he tends not to explicitly make a description at all three levels for all the artworks he analyzed, as only half of the artworks are described at all the levels. In fact, most artworks having a description at only one level (21%) only include the third level of interpretation. This means that the outcome of his iconographical analysis is not presented in his texts, and it constitutes the basis for an iconological recognition without being discussed, justified (nor questioned). A possible explanation for this might be that Panofsky himself states that not all levels may be explicitly stated during an interpretation, as the context makes implicit knowledge clear (Panofsky, 1955).

Iconological interpretations. The network of iconological recognitions supporting each other, citing artworks as evidence, expanded with the network of recognized cultural phenomena, reveals a high interconnection and complexity. Therefore, we can claim it reflects the complexity of an iconological interpretation. Although it is not possible to retrace the single interpretation made by the art historian, the network allows us to connect multiple topics, making explicit previously hidden connections between interpretations. As a consequence, network visualization, as well as supporting statistical graphs, can be a valuable tool for the distant reading (Moretti, 2000) of the overall art historian's understanding of iconological phenomena.

9.1.3.3 Inquiries into the iconological method

Rq 4.1b aimed at 1) evaluating the necessity of detailed artwork description at multiple levels to understand a deeper cultural phenomenon and 2) checking if the artwork's description grade varies across selected bibliography books due to author writing styles.

Degree of the description of artworks having a cultural phenomenon. Results of the domain-specific analysis previously described seem to suggest that recognitions of cultural phenomena are poorly supported by textual evidence and by the description at other levels. This analysis deepened the extent to which artworks are related to pre and iconographical analysis, as Panosky underlines that they are essential for a

correct iconological interpretation. Results show that 10% of the phenomena (40 in total) are recognized in artworks with no further description and no apparent support for recognizing the phenomenon. Nevertheless, this number is drastically reduced by visualizing the results as a network in which artworks having common phenomena are related. Therefore, results seem to suggest that artworks described solely at the third level are part of broader networks of cultural phenomena in which at least one artwork has a multiple-level description. According to Panofsky's indication, a thorough pre- and iconographical artwork description is needed, either in the same artwork or in other ones presumably presenting similar characteristics, to achieve a deeper meaning.

Degree of the description of artworks having a cultural phenomenon in relation to the textual source. The second research question of the inquiry aimed at understanding if the artworks' degree of description varied according to the textual source describing them. To this aim, we visualized a network grouping artworks according to the textual source, distinguishing between artworks with multi-level or only third-level descriptions. As the number of artworks of the last group varies according to the textual source, we can assume that the style of the book or article has a significant impact on the detail with which the artworks are described.

9.2 Impact of the research

Besides the aforementioned contributions, the research conducted in this thesis has potential applications in related contexts.

The study offers a methodology for data-driven iconological inquiries that may be applied to data describing further iconological interpretations. By performing it over representative samples of the art of a period, interesting representative insights may be reached.

Another field of application could be the catalog entries of museum collections, in which a detailed description of the artwork, including the scholar's interpretation, may be provided in a free text format. Such information may be converted according to ICON ontology to foster the information access and retrieval of complex iconographical and iconological subjects and meanings. Websites storing art bibliographies (e.g., Kubikat[3], OpenBibArt[4]) would similarly benefit from the inclusion in their metadata of such domain-specific descriptions. By having available the references to artworks and their iconography interpreted in the bibliographical records as part of the item metadata, art historians could easily retrieve the bibliographic references in which complex iconographies are described (e.g., searching for all the books in which an artwork depicts Venus with a slate or with a specific deeper meaning associated).

3 https://aleph.mpg.de/F?func=file&file_name=find-b&local_base=kub01&con_lng=eng
4 https://openbibart.fr/cms/?lang=en

Furthermore, traditional historiographical studies may benefit from the data analysis performed. First, the unexpected results of Panofsky's method, showing a poor description of artworks and a limited reference to textual sources, can foster new qualitative studies on his method. Second, as a unique top-down definition of a theoretical approach to the discipline is challenging, a bottom-up, data-driven approach to finding commonalities among art historians' studies could help define a robust and shared method. To this end, the methodology applied here to Panofsky could be repeated for the theory and studies of other art historians.

Finally, as nearly all the artworks described have a deeper meaning (third level), the dataset could be beneficial for advancements in computer vision and machine learning studies aiming to go further in the research by inferring cultural meanings of artworks.

9.3 Limitations

Despite the positive results, the approach presents some limitations. The ICON ontology provides a means for describing iconological interpretations granularly. However, despite descriptions of visual aspects can be performed, it is limited to figurative art only. Another pitfall is that, as a consistent use of reification is made, the ontology may not perform good results in terms of efficiency when applied to a large dataset. Nevertheless, complexity is needed when the aim is to provide a thorough description of several aspects with the detail required by domain-specific research.

Furthermore, the modeling focused on the description of works of art. However, during the dataset population phase, we observed that a significant part of the study was often dedicated to the explanation of the context or culture rather than the artworks (e.g., the tradition of a classical text in different contexts and the different meanings and textual variations it acquires time after time). The limit of the approach is evident, for example, in the book chapter *Suger abbot of Saint Denis* (Panofsky, 1955). Since the presence of artwork images was the criterion for selection, this chapter could not be included in the current study, as it described passage to a Gothic style perception through the decisions of the abbot himself, with no explicit reference to actual works of art. Additionally, the modeling adopted, which is based on the perspective of the artwork, bound the insight into the evolution of themes of interest of the domain (e.g., iconographies, cultural aspects) to the sole evidence provided by each single artwork. This prevents us from formally describing the chain of evolution reconstructed by the art historian.

Moreover, as underlined by the dataset evaluation, manual data curation guarantees data quality. Nevertheless, given the complexity of Panofsky's writings, the content extracted is subject to the annotator's interpretation.

Finally, since the dataset focuses on some core interests of the art historian Erwin Panofsky, it cannot be considered representative of Medieval and Renaissance Western art, nor should the results of the quantitative analysis be read in this sense. The limited scope also explains why we were unable to fully address some research questions. Results should also be cautiously interpreted, as further studies are needed to confirm them, and some features may be affected by the modeling adopted or by the limitations of the small data taken as a source.

9.4 Conclusions and future work

The current work advanced the state of the art of Digital Art History in the domain of iconology and iconography by providing a tool for formally describing art interpretation (i.e., ICON ontology), a dataset of authoritative assertions (the Iconology Dataset), and a quantitative analysis.

The analysis shows the potential that the quantitative approach may have for the research field, both in terms of distant reading and information retrieval. We demonstrated that the expression of Panofsky's theory from an ontological perspective is not only valuable to pursuing quantitative analysis for the domain itself but also for having insights into experts' claims, with unexpected results that can be the basis for further qualitative research, including both iconological and historiographical aspects. Data exploration can constitute a new perspective for deeper insights into the historian's claims. It can be expanded by including iconological interpretations of other art historians to enable comparative analyses and exploration of networks through the competing narratives of experts' interpretations.

This contribution enables the linking of artworks based on their content, facilitating content-based research questions in art history to enter the realm of linked open data. As a result, the digital space becomes a platform where various personal perspectives converge, faithfully reflecting the traditional ways in which specialized knowledge is expressed and allowing distant reading of scholars' insights.

Future work is envisioned in multiple directions: ontological modeling, data description, analysis, and retrieval.

For the relevance given to sociocultural aspects in iconological studies, future ontological development includes modeling cultural changes to be pursued in collaboration with experts from anthropology and social sciences. Moreover, more work will need to be done to model the relevant topic of the concept of evolution to describe the iconographical variations and resemantization provided by the scholars' interpretation. A further study could also assess the feasibility of expanding the model to include 1) non-figurative art descriptions and 2) a lighter ontology version.

Furthermore, we envision the creation of a dataset representative of a particular period to extend the investigation and provide the discipline with valuable and representative results.

Finally, to foster access to data by art historians, work to study interfaces to simplify the interaction with data, offering a high level of data collection and information retrieval customization without the need to code, should be addressed.