**Folio Metaphysics**
**Wholes and Parts in Cultural Objects**

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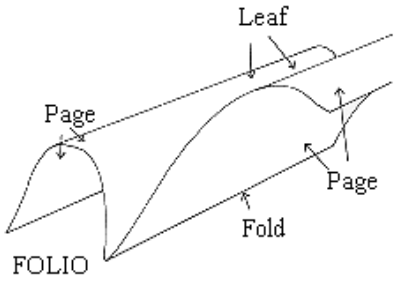
## Abstract

The Visual Resources Association developed the VRACore Schema with the goal of creating an interoperable format for describing cultural objects. However, unlike VRACore lacks a formal ontology for the materials it intends to describe. This paper uses the example of a folio to explore how mereologic frameworks can illustrate potential problems for cultural heritage metadata, and how cultural heritage metadata can illustrate potential problems in mereologic frameworks.

Imagine for a moment a piece of parchment; a thin sheet of carefully prepared skin intended to function as a writing surface. This parchment is folded in the middle, the crease defining two *leaves*. The leaves are further subdivided in to *pages* upon which a scribe might spend hours or days drafting text or painting a scene. As a whole, these individual parts are known as a *folio*.[1]




In April of 2006, members of the Visual Resources Association listserv initiated a week-long conversation about the nature of whole-part relationships of folios. Practices established by the *Index of Christian Art (ICA)* recommended that each *page* of the folio should be described as a separate record, especially since different pages of manuscript folios often contain different intellectual content (and often assigned titles, subjects, descriptions, etc. that are different from their wholes). By creating separate records, system developers are challenged with reassembling the parts into wholes for browsing in sequence or in order to present all pages that are part of a folio.

The practice of describing individual pages, presented the VRA community with a challenge when applying the VRACore 4.0 standard that requires the selection of a record type of *Work, Image* or *Collection*.[2] Should *pages* that are parts of folios be considered

[1] *Folio* can have several meanings. According to the Society of American Archivists Glossary of Archival Terms, folio may indicate a s ingle leaf in a book or a book size made from sheets folded in half. Other common resources on bookbinding and book construction conservation use the definition provided here – a sheet folded in half to create two leaves and four pages. See Ogden, 1999. Image Courtesy of the Northeast Document Conservation Center.

[2] In the VRACore 4.0 XML Schema, *work, image* and *collection* are root elements for a record that include

*Works* and merit their own records*?* Examples of practice seemed to provide an answer that countered those used for describing folios. A house would have a *Work* record with relationships to *Image* records that depicted parts of the house. A Greek vase would be treated similarly- one *Work* record associated with multiple *Image* records. Yet participants also offered counter examples. For example a triptych might have a *Work* record for each panel with multiple *Image* records showing details of the panel. Participants in the conversation were frustrated by the different examples of how whole-part relationships were being established in practice. It appeared that entities such as *pages* were receiving privileged treatment over parts of other complex *Works* that, in theory, shared similar whole-part relationships.

The problems raised in this conversation among practitioners are similar to the those that philosophers have troubled over for hundreds of years. This paper explores whether the framework for whole-part relationships created by Winston, Chaffin and Hermann can offer practitioners any guidance in their day-to-day task of describing complex works of art and other cultural heritage artifacts (Winston, et al., 1987). The WCH framework was selected because it presents an accessible approach for practitioners and because other philosophers often cite it as their point of departure for more complex frameworks. A goal of the WCH framework is also to avoid transitivity problems of part-whole relationships by identifying different senses of "part of." If VRA would like the ability to construct descriptions of wholes from records describing parts, avoiding such transitivity paradoxes will be an important part of achieving success.

## The VRACore

The VRACore was developed by the Visual Resources Association, a membership organization that represents practitioners responsible for the management of slide libraries used in educational settings. Visual resources collections are often comprised of images of paintings, drawings, sculpture, architectural structures, historic sites, landscapes, and performance art. Dissatisfied with the generic descriptions offered by the Dublin Core Metadata Initiative, the VRA community decided to extend Dublin Core so that it was better attuned to describing the works of art requested by their users. With Dublin Core as its model, VRACore was intended provide interoperability among VRA collections and with other metadata communities.

Released in December of 2005, VRACore 4.0 included both a narrative description of proposed data elements and an XML Schema that provided a method of encoding VRACore records. While the Schema provides a more formalized representation of the narrative, neither are based on any formal ontology of the artifacts they intend to describe. In observing the conversation about folios, this lack of a formal ontology

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all other VRACore elements. See both the VRACore Introduction and VRACore Element Description and Examples. E.g.

```
<work>
    <title></title>
    <date></date>
    <description></description>
</work>
```

creates the possibility that parts of works may be confused with whole works when records from different domains or institutions are aggregated. While VRACore records may be syntactically interoperable, this does not guarantee semantically interoperable. This concern warrants a closer look at VRACore to highlight potential issues in general and specifically in the case of our folio.

## *VRACore Works*

Among the changes in VRACore 4.0 was the deprecation of the VRACore 3.0 *Record Type* in favor of the root elements of *Work, Image,* or *Collection.*[3] While VRACore 3.0 recommended similar values for *Record Type,* without an encoding Schema to enforce it, practitioners were free to adapt it to their own situations. With the introduction of the XML Schema, the choice of the three record types was enforced and leads to the conundrum outlined in the conversation above. For our purposes we will focus only on VRACore's definition of *Works*:

> A *work* is a unique entity such as an object or event. Examples include a painting, sculpture, or photograph; a building or other construction in the built environment; an object of material culture, or a performance. Works may be simple or complex. Works may have component parts that are cataloged as works themselves but related to the larger work in a whole/part or hierarchical fashion.

The Schema behaves according to this definition and requires practitioners to create a record with the <work> element as the root node in a record. However, while we can reason about whether a record of the type *Work* is a whole work or part of a work, the <work> element does not provide us with sufficient information to infer whether it is part or whole, or where in a heirachy of part-whole relationships this part may fit.

The distinction of whether a <work> record indicates a whole or a part is left to the cataloger's judgment without any criteria to base this judgment. Examples provided in the VRACore documentation, as suggested by those provided in the folio conversation, at times offer conflicting advice about when parts are parts and wholes are wholes.

## *Work-to-Work Relationships*

The recommended solution to the problem of describing folio pages was to include a *VRACore Relationship* element. A *Relationship* element may carry a *type* attribute that identifies the kind of relationship being established between records.

*Table 1 Selected Relationship Types Defined by VRACore 4.0*[4]

| **Relationship Type** | **Reciprocal Relationship** |
|---|---|
| ***Hierarchical – group/collection/series to parts*** | |
| Part of | Larger context for |

[3] We note that the VRACore documentation often confuses discussions of VRACore element names (in the sense of proposed data elements for a generalized standard, such as the Dublin Core Metadata Element Set) and XML Schema Elements.

[4] See the VRACore Element Definitions for a complete list of Relationship Types.

| | |
|---|---|
| Formerly part of | Formerly larger context for |
| ***A work and its components*** | |
| Component of | Component is |
| Partner in set with | Partner in set with |

We note that the different terminology of relationships and reciprocal relationships can make a clear understanding of relationship types difficult. For example "part of" is not being used here in the general sense, but could be written, "is part of a larger context." Nowhere in the documentation is the scope of *context* defined. Likewise VRACore appears to be using *partner in set with* in the sense of "the cup is part of the teaset" with the "teaset" taken as the whole. It is unclear what makes a "teaset" not a group or collection.

The VRACore 4.0 Schema was developed during the same period that VRA was completing *Cataloging for Cultural Objects (CCO): A Guide to Describing Cultural Works and Their Images* (VRA, 2005). It was intended as a companion to the content rules and guidelines found in the *Anglo-American Cataloging Rules (AACR2)* and follows the precedent of other specialized communities, e.g. rare books, manuscripts, and archives, who have developed extensions to *AACR2*. VRACore draws some of its understanding of relationships between works and wholes and parts from those used in *CCO*. As specified in *CCO* and the VRACore Introduction, "there are two types of work to work relationships: intrinsic and extrinsic:"

> An *intrinsic* relationship exists where the described work is dependent on the referenced work, either physically or logically, for its identity. This dependency is typically part-to-whole, such as a component of an architectural complex, a panel of an altarpiece, a page of a manuscript, or an individual work in a series. The cataloger should use the RELATION element to establish a virtual link between the two works.
>
> An *extrinsic* relationship between two works exists when the described and referenced works could stand independently and the relationship is informative but not essential either physically or logically in identifying either of the works.

This definition of works and parts of works continues to be underdeveloped. The notions of physical dependency, logical dependency, and informative relationships in particular remain unclear. Neither *CCO* nor VRACore provided sufficient examples to better understand what is meant by *intrinsic* and *extrinsic* relationships in theory or practice.

The ability to infer whether a <work> record is a related part of a larger work is further confused by the ability to apply a global XML attribute called *extent.* "*Extent* refers to the work, part of the work, image, collection being described by the element or sub-element that it modifies." While *extent* can be applied anywhere, VRACore provides examples of its use as an attribute of the *Measurement* element. For example, within a

<work> record we may record a measurement for the base of a sculpture and the body of the sculpture.

## The Mereological Background

Given these intriguing definitions from the VRACore documentation, how might practitioners go about refining their understanding and application of these concepts to real artifacts? As a general background for analyzing these problems we will be using the frequently cited framework presented by Winston, Chaffin and Herman (WCH). The WCH approach presents an account of the simple English term "part of" by distinguishing six types of meronymic relations based on the criteria of *functionality, homeomerticity* and *separability* (Winston, et al., 1987).

- *Functional/non-functional:* The part plays a functional role within the whole and is limited to particular spatial positions by that function. E.g. a lid can only function as a lid if it is in the correct position (that is, on top of a jar).
- *Homeomerous/non-homeomerous:* "homeomerous parts are the same kind of thing as their wholes," for example swatch-cloth, "while non-homeomerous parts are different from their wholes", e.g. thread-cloth.
- *Separable/Inseparable:* separable things can be separated from a whole, e.g., lid-jar, while inseparable parts cannot, e.g. clay-jar.

Using these three criteria, the WCH framework defines six types of mereonymic relationships as:

*Table 2 Six Types of Mereonymic Relations with Relation Elements presented in WCH.*

| | | **Relation Elements** | | |
|---|---|---|---|---|
| **Relation** | **Examples** | **Functional** | **Homeomerous** | **Separable** |
| Component/Integral Object | Handle-cup | + | - | + |
| Member/Collection | Tree-forest | - | - | + |
| Portion/Mass | Grain-salt | - | + | + |
| Stuff/Object | Gin-martini | - | - | - |
| Feature/Activity | Paying-shopping | + | - | - |
| Place/area | Everglades-Forest | - | + | - |

- *Component/Integral Object:* "Integral objects are characterized by having a structure, while their components are separable and have a specific functionality" (Artale, 1996).[5] E.g Spines are parts of books, wheels are parts of ships.
- *Member/Collection:* Members of collections do not perform a particular function within the whole. While they do not need to occupy a specific spatial arrangement they are distinct from classes of things with similar properties. E.g. a print is part of the series. This saucer is part of the teaset.
- *Portion/Mass:* Portions of homeomerous masses can be separated from the whole

[5] Definitions from Artale are included here as they are more compact than WCH's longer narrative explanations of different types.

and continue to be similar to it (homeomerous). E.g. This hunk is part of my clay, this splinter is part of the Cross.

- *Stuff/Object*: Describes inseparable portions of objects. E.g this jar is partly clay, this book is partly paper.
- *Feature/Activity*: "Designates a phases of activity." (Artale, et al., 1995). E.g. spinning is part of making thread, weaving is part of making cloth.
- *Place/Area:* The relationship between areas and locations within them. E.g. the Acropolis is part of Athens. The margin is part of the page.

The WCH approach attempts to overcome the problem of "transitivity paradoxes," such as arms being parts of orchestras, by identifying these several types of specialized whole-part relations. It is their argument that transitivity problems occur when these types of relationships are mixed with non-mereonymic relationships. Examples include topological inclusion (the wine is in the jar), class inclusion (jars are vessels), attribution (the vase is beautiful), attachment (the label is part of the artifact), and ownership (a museum has paintings).

## *The Mereology of the Folio*

Let us turn now to our example case of a folio in order to demonstrate some of the difficulties in consistently identifying relationships using VRACore. Using the WCH framework we will focus on the "stuff" of a folio, independent of any intellectual components (such as chapters, paragraphs, sentences, etc.). A catalog of the folio's "stuff" includes: the parchment, the leaves defined by the fold, the surfaces of the leaf which form pages, and ink or other pigments.

**Parchment: Stuff-Object**

The major part of our folio is the parchment, that " unlike components, the stuff of which a thing is made cannot be separated from the object, though, of course, the same type of object can sometimes be made of different stuff ," e.g. a folio made of paper instead of parchment (Winston, et al., 1987). Although later we will argue that ink is separable from the parchment it is difficult to conceive of removing the parchment from the whole folio. We can conceive of a blank folio without any ink, say before the monk has begun writing, but without the parchment there would be nothing for the ink to be a part of.[6]

A folio is partly parchment.
(1a) Parchment is *nonfunctional*
(1b) Parchment is *inseparable*
(1c) Parchment is *non-homeomerous*

**Leaf: Component-Integral Object**

[6] For the purpose of this paper we will not be exploring the issue of dependence as outlined by Simons or Artale, et al.'s discussion of functional dependence. (Simons, 1987. Artale, 1996).

Evidence that leaves are separable can be found in many collections that hold leaves that were formerly parts of folios. They are distinct from *pieces* of folios (e.g. a fragment torn from a folio) and from a sheet paper that may share similar properties. As parts of folios, leaves "exhibit some kind of patterned organization and structure....and bear specific structural and functional relationships to one another and wholes which they compose." and may be considered functional (Winston, et al., 1987). Leaves appear to have a homeomerous relationship with the whole folio, in that they are also partly parchment. However, the WCH framework does not include a type that is functional, separable and homeomerous. If we hold that leaves are function and separable, in order to be *component-integral objects* they must be considered *non-homeomerous.* If we accept that leaves are homeomerous and separable but non-functional, we might consider a leaf the same as portion-mass, e.g. "slice-pie." Intuitively this seems to insufficiently account for the role leaves play in a folio. We might argue that leaves are inseparable parts, because without leaves the whole of the folio ceases to exist. In addition to being counterintuitive, the WCH framework also lacks a type for parts that are functional, homeomerous and inseparable. For the moment let us accept that:

A leaf is part of a folio.
(2a) A leaf is *functional*
(2b) A leaf is *separable*
(2c) A leaf is *non-homeomerous*

**Page: Place-Area**

Pages again present us with a challenge. We discount topological inclusion, e.g "The wine is in the cooler," because pages are parts of leaves because they are "co-extensive in the sense that" pages overlap the leaf and every part of a page is also part of the leaf, suggesting that pages are *places,* e.g. Everglades-Florida (Winston, et al.m 1987). The WCH statement that"...places are not parts by virtue of any functional contribution to the whole." is troublesome because in order for pages to fulfill then *Place-Area* relation, they must be considered *nonfunctional.*

We note that a difficulty in talking about pages is confusion between the stuff of a page and the page as a unit of intellectual content. For example, "I have my finger on the page" versus "I read the page." While pages do serve a functional role in defining the spatial relationships of the intellectual content on the page, in the context of a folio's "stuff" pages are merely one surface of a leaf and may be considered to lack a function in the WCH framework. In practice, pages are identified by their location in respect to the leaf, i.e. *recto* and *verso* suggesting that *Place-Area* is the correct WCH type. In the sense that pages are, at least two-dimensional surfaces of the leaf they may be considered homeomerous with leaf.

Pages are parts of a leaves.
(3a) Pages are *nonfunctional*
(3b) Pages are *inseparable.*

(3c) Pages are *homeomerous*

**Ink: Component-Integral Object**

The final part of our folio is the ink or other pigments used to create text or illuminations. We can discount the non-mereonymic relationship of *attachment* if we consider that ink, etc., plays an important functional role in making a folio more than just a piece of parchment. Ink, however is dissimilar to other parts of the folio and is therefore non-homeomerous. A common practice was the removal of ink from a page in order to use it for other purposes, indicating that ink is also separable.

Ink is part of a page.
(4a) Ink is *functional*
(4b) Ink is *separable*
(4c) Ink is *non-homeomerous*

## Conclusions

We hoped that this exercise using the WCH framework would offer some conclusions that could be useful to practitioners in their day-to-day practice. Ideally this exercise would have yielded some validation that the *Work-to-Work* relationships between VRACore records could be modeled on a syllogism such as:

(5a) A leaf is part of a folio
(5b) A page is part of a leaf
(5c) A page is part of a folio

However, the difficulties assigning acceptable WCH types to leaves and pages suggest that the WCH framework may be insufficient for application to this practical problem. Artale, et al. note that the WCH framework and Grounded Existential Mereology, in general, is "inappropriate when considering real domains of application of the theory" (Artale, 1996). Gerstl and Pribbenow offer additional criticisms of the WCH framework that parallel the difficulties we encounter here. (Gerstl and Pribbenow, 1995, 1996). Notably, they also identify the lack of several possible mereonymic types that WCH omits, such as functional-separable-homeomerous. Their concept of PORTIONS and SEGMENTS may prove useful in understanding the difficult relationships between whole folios and the parts of leaves and pages and warrants further exploration.

While this paper has not resulted in any definitive advice for VRA practitioners, it has highlighted not only the complex challenges they face in their day-to-day activities, but also the need for "common-sense" theories of whole-part relations that can be applied to actual practice (Gerstl and Pribbenow, 1995).

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