FROM THE WALL TO THE WEB:
A MICROFORMAT FOR VISUAL ART

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# TABLE OF CONTENTS

LIST OF FIGURES....................................................................................................................v
LIST OF TABLES.......................................................................................................................vi
ACKNOWLEDGMENTS..............................................................................................................vii
PREFACE...................................................................................................................................viii

CHAPTER I INTRODUCTION: WHAT IS SEMANTIC WEB?.................................................1
  A Look Back............................................................................................................................1
  Defining Semantic Web .........................................................................................................2
  Semantic Web and RDF.........................................................................................................4
  Linked Data and Issues with RDF.........................................................................................6

CHAPTER II MICROFORMATS.........................................................................................7
  An Elemental Microformat .....................................................................................................8
  A Compound Microformat .................................................................................................11
  Microformats Principles ......................................................................................................13
  Microformats Development Process .................................................................................14
  Applications and Benefits .................................................................................................16

CHAPTER III FROM THE WALL TO THE WEB..............................................................18
  Revealing the Inaccessible....................................................................................................18
  Research...............................................................................................................................19
  Current Web Practices.........................................................................................................24
  In Summary.........................................................................................................................26

CHAPTER IV VISUAL ART MICROFORMAT SCHEMA PROPOSAL............................28
  Related Metadata Sets ........................................................................................................28
  Figure Microformat Draft....................................................................................................28
  Dublin Core........................................................................................................................28
  VRA Core............................................................................................................................30
  The Proposal.......................................................................................................................31
Table of Contents

CHAPTER V A LOOK AHEAD ................................................................. 36
  Potential Applications .................................................................. 36
  Better Search ............................................................................... 36
  Easier Exchange of Data ............................................................... 37
  Additional Tools .......................................................................... 38

CHAPTER VI BEYOND SPECIFICATIONS ..................................... 41
  Current State of Technology ....................................................... 41
  Operator Plug-in ......................................................................... 42
  Oomph Plug-in and Library .......................................................... 43
  Microformats Bookmarklet ......................................................... 44
  Transient User Interface ............................................................. 45
  Visual Art Visualized ................................................................... 47

CHAPTER VII CONCLUSION ......................................................... 50

REFERENCES .................................................................................. 52
LIST OF FIGURES

Figure 1. Protégé RDF editor ........................................................................................................5
Figure 2. An address on the Cleveland Museum of Art web site ..................................................8
Figure 3. An address on the Cleveland Museum of Art web site revised to include the Adr-microformat .................................................................8
Figure 4. Basic contact information of a fictional person described with the hCard microformat .................................................................................................12
Figure 5. Microformats development process .................................................................................15
Figure 6. Mont-Sainte-Victoire, ca. 1902-06 by Paul Cézanne next to its label at the Nelson-Atkins Museum of Art ..........................................................20
Figure 7. Water Lilies, 1919-26 by Claude Monet next to its label at the Cleveland Museum of Art .................................................................................................20
Figure 8. Bordner Mural, 1936-37 by William Sommer next to its label at the Akron Art Museum .................................................................................................21
Figure 9. Rising Sun, 1958 by Hans Hoffmann next to its label at the Kemper Museum of Contemporary Art ..................................................................................21
Figure 10. A label on the Akron Art Museum web site ...................................................................24
Figure 11. A label on the Nelson-Atkins Museum of Art web site ................................................25
Figure 12. A label on the Kemper Museum of Contemporary Art web site ..................................25
Figure 13. A label on the Cleveland Museum of Art web site .........................................................26
Figure 14. Group of Attendants, Kota Region, Rajasthan, India, 12th–13th c. next to its label at the Nelson-Atkins Museum of Art ......................................................................38
Figure 15. Operator plug-in for Mozilla Firefox developed by Michael Kaply ..............................42
Figure 16. Oomph plug-in for Internet Explorer .........................................................................43
Figure 17. Bookmarklet for detecting microformats made by Remy Sharp..................................44
Figure 18. Data detectors in Apple’s Mail ......................................................................................46
Figure 19. Still of the Interface I: The Visual Art microformat on a fictional list page ...............47
Figure 20. Still of the Interface II: The Visual Art microformat on a fictional detail page ...........48
Figure 21. Still of the Interface III: The Visual Art microformat on a fictional detail page ..........49
LIST OF TABLES

Table 1. Elemental microformats ................................................................. 11
Table 2. Full element set of the hCard microformat ................................. 13
Table 3. Compound microformats ............................................................... 14
Table 4. Label elements currently used by museums researched .................. 27
Table 5. Dublin Core metadata element set ............................................... 29
Table 6. VRA Core 4.0 metadata element set ............................................ 30
Table 7. Elements and definitions of the proposed Visual Art microformat .......................... 32
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When I was an undergraduate student at Edinboro University of Pennsylvania, I worked for the Art History department. My job was to digitize as many 35 mm analog slides as I could from a library of thousands. With a brand new batch scanner speeding up what was previously a tremendously menial task, I enjoyed looking at masterpieces for several hours a day. Not long after starting, I discovered that some of the slides in the department’s library had deteriorated to the point of being barely usable. Scanning such slides at high resolutions was simply a waste of resources. The quality of the images on the web was much higher then that of the slides, but finding them was often an arduous process.

I had to label the newly digitized images by retyping what had been printed on the slides, so as to make browsing and searching possible. Again, I had to turn to the web in search for a complete label because many slides were missing the year in which the artwork was completed or other significant information. Some slides had partially or completely illegible handwritten labels. Others simply did not have enough space on their plastic or cardboard surfaces to fit the entirety of a long label.

As a student, I regularly accessed my art history instructor’s web site to retrieve study pages. These were usually web pages or Microsoft Word documents with lists of images and captions which needed to be memorized for exams. Frequently, I copied pieces of artwork labels one by one, and pasted them into a spreadsheet application. I wanted to be able to group all works by a single artist. I also wanted to group all works completed in the same year and identify both earliest and latest works. Grouping pieces in this way allowed me to observe relationships between the works which in turn helped me memorize them more easily. Creating a spreadsheet was one way of accomplishing this but it made the challenges of data portability painfully obvious.

I first learned about microformats shortly after I started actively designing and developing web sites. I had not been fully aware of the ideas behind various semantic web initiatives yet. I simply became captivated by microformats because they solved simple problems of data transfer gracefully and comprehensibly. Immediately, I knew that the ideas behind microformats could be used with art images on the web. As I learned about semantic web technologies in greater detail and expanded my web development capabilities, I became convinced that there
was an even greater potential in describing the artwork on the web in a way that is machine-processable but designed for human use first. This thesis is set out to examine how some of these problems might be addressed by describing artwork labels on the web semantically, by using a microformat dedicated to visual art.

On a technical note, to make this thesis as clear as possible, I used the following layout conventions. Markup is presented in fixed-width type. Important words in markup listings and figures are presented in bold type. In addition to emphasis, italic type is used for both the names of microformats and the names of elements belonging to any microformat or metadata set.
CHAPTER I
INTRODUCTION: WHAT IS SEMANTIC WEB?

A Look Back

As of June 30th 2009, it is estimated that 1.6 billion people globally use the Internet (World Internet Usage, 2009). It is safe to say that the World Wide Web, a part of the Internet which allows us to read and interact with web sites and web pages, is the most popular application of the Internet. The idea of linked documents navigable in a non-linear fashion was first proposed in 1945 by American engineer Vannevar Bush in his paper “As We May Think.” In 1965, American technologist Ted Nelson coined the term “hypertext” in his paper “A File Structure for the Complex, the Changing and Intermediate.” However, the first practical implementations of these ideas did not appear until the 1980s. Gopher was a campus-wide information system developed for the University of Minnesota. It allowed its users to share and retrieve documents by navigating a hierarchical file structure similar to a desktop computer’s. HyperCard was an application used on Apple Computer’s Macintosh operating system. It offered a way to make “cards,” or pages that contained text, images, sound, and video and could be linked together and navigated in a non-linear path. Tim Berners-Lee, a physicist who was employed at the European Organization for Nuclear Research (CERN), was faced by the same problem of incompatibility between different systems (Berners-Lee & Fischetti, 1999). CERN, near Geneva, Switzerland, attracted researchers from around the world who performed experiments using CERN’s massive and expensive particle accelerator. In Berners-Lee’s own account: “The scientists brought a wide variety of computers, software, and procedures, with them [...]” (Berners-Lee & Fischetti, 1999, p. 8). To allow for an easier exchange and storage of disparate information, Berners-Lee created several prototypes of applications loosely based on the idea of a web of interlinked documents, allowing links to be arbitrarily made between any two nodes in the web. To achieve his goals, the web had to accommodate documents in both different locations and formats or at least provide a format that documents could be easily converted to in order to be accessible. It was not until Berners-Lee charted several proposals for what he called the World Wide Web, that the concept of a linked web of data was seen as potentially universal, i.e. able to transcend different systems (both architecturally and spatially).
and incorporate various documents into its structure. It is precisely this global and inclusive nature that led to the universal adoption of the World Wide Web.

There are three components that make the World Wide Web work (Berners-Lee & Fischetti, 1999, p. 36). The first is what Berners-Lee dubbed universal resource identifiers (URIs), which act as unambiguous addresses for any node on the web. Second is the hypertext transfer protocol (HTTP), or a set of rules that, at a technical level, govern the communication of document data. Finally, the hypertext markup language (HTML) provides a common format for representing the data. Berners-Lee and Fischetti (1999) clarify that when two computers agree they can talk, they then have to find a common way to represent their data so they can share it. If they use the same software for documents and graphics, they can share directly. If not, they can both translate to HTML. (pp. 36-37)

The URIs (nowadays also referred to as URLs) have changed very little in the twenty years since the web’s birth. HTTP has changed slightly more and HTML has changed considerably since Berners-Lee’s original proposals. As the World Wide Web has skyrocketed in popularity, more was asked of it. The original HTML was capable of representing structures like headings, paragraphs, and lists in scientific papers. But the demands of entertainment, education, government, and commerce, have meant that HTML has had to undergo considerable evolution. If anything, the evolution of HTML has been too slow to adapt to all the demands thrown at it.

**Defining Semantic Web**

Illustrating what the future of the web will look like, Berners-Lee, Hendler, and Lassila (2001) provide an example:

The entertainment system was belting out the Beatles’ “We Can Work It Out” when the phone rang. When Pete answered, his phone turned the sound down by sending a message to all the other local devices that had a volume control. His sister, Lucy, was on the line from the doctor’s office: “Mom needs to see a specialist and then has to have a series of physical therapy sessions. Biweekly or something. I’m going to have my agent set up the appointments.” Pete immediately agreed to share the chauffeuring. At the doctor’s office, Lucy instructed her Semantic Web agent through her handheld Web browser. The agent promptly retrieved information about Mom’s prescribed
treatment from the doctor’s agent, looked up several lists of providers, and checked for the ones in-plan for Mom’s insurance within a 20-mile radius of her home and with a rating of excellent or very good on trusted rating services. It then began trying to find a match between available appointment times (supplied by the agents of individual providers through their Web sites) and Pete’s and Lucy’s busy schedules. (The emphasized keywords indicate terms whose semantics, or meaning, were defined for the agent through the Semantic Web.) (para. 1-2)

While Berners-Lee has described the vision for the World Wide Web as a system that “allows some degree of automatic analysis” in his original 1989 proposal, the three building blocks of the web are alone incapable of useful automation (Berners-Lee & Fischetti, 1999, p. 21). Devedžić (2006) clarifies that “the Web was built for human consumption, not for machine consumption – although everything on the web is machine-readable, it is not machine-understandable (Lassila, 1998)” (p. 30). In other words, computers can understand the syntax of HTML documents (e.g. which part of a document is a headline, which parts are paragraphs, or lists, what is emphasized or quoted, etc.) but computers have no understanding of the semantics of HTML documents (e.g. what those headlines and paragraphs mean or represent). Semantic web is World Wide Web composed of documents infused with meaning which machines can understand (Yu, 2007, p. 9). For example, on the semantic web, computers should understand that a fragment of text is not merely a sequence of alphanumerical characters functioning as a paragraph in a document, but that the text actually represents a date, person or any other concept we can define. Daconta, Obrst & Smith (2003) elaborate that besides understanding what concepts the objects in documents represent, computers on the semantic web should also be able to understand the relations between different concepts (p. 1). The ultimate goal of the semantic web is to allow us to process, use, and share information by using software with an efficiency and scale previously unimaginable. Berners-Lee and Fischetti (1999) write that once computers are able to understand the concepts and relations the day-to-day mechanisms of trade, bureaucracy, and our daily lives will be handled by machines talking to machines, leaving humans to provide the inspiration and intuition. The intelligent “agents” people have touted for ages will finally materialize. (p. 158)
Berners-Lee, Hendler, & Lassila (2001) also note that “the Semantic Web is not a separate Web but an extension of the current one, in which information is given well-defined meaning, better enabling computers and people to work in cooperation” (para. 8).

Semantic Web and RDF

Although there is a dizzying number of acronyms and technologies related to the semantic web (e.g. XPath, XSL, SPARQL, GRDDL, XQuery, XLink, XInclude, SVG, OWL, etc.) the building block that makes it possible is called RDF (resource description framework). Daconta, Obrst, & Smith (2003) state that “at the simplest level, the Resource Description Framework is an XML-based language to describe resources” (p. 85). A less academic term for resources would be “things.” Things can be people, documents, paintings, addresses, or virtually anything. RDF defines expressions in forms of triples which allow authors to define both resources and their mutual relationships. Triples are articulated in a subject-predicate-object form. For example, a sentence “Jonathan Johnson works at the Widget Corporation” is a triple, where “Jonathan Johnson” is a subject, “works” is a predicate, and “Widget Corporation” is an object, each of which must point to a URI that defines it. To use an analogy, RDF is to the semantics of web documents what HTML is to their syntax.

Besides having an obviously different role, there is another significant difference between RDF and HTML. While many claim that HTML is not easily read or written by humans, some degree of effort will generally render HTML tags intelligible. In fact, numerous web designers and developers prefer to write HTML documents directly. This is not the case with RDF since even the simplest relationships described in RDF syntax can be seemingly impenetrable by bare eyes. Although the World Wide Web Consortium (W3C), a body founded and headed by Berners-Lee to steer the development of the web, proposed RDF in 1999, it has not gained a widespread adoption. The primary reason for this is RDF’s complexity. Daconta, Obrst, & Smith (2003) note that “The hierarchical RDF/XML syntax ... is difficult to author by hand and is better left to tools” (p. 99). The RDF authoring tools, such as Protégé, (Figure 1.) developed at Stanford University, typically depict resources and relations visually, in form of semantic network diagrams, which humans manipulate to generate complex documents containing RDF code.
Berners-Lee recounts:

I never intended HTML source code (the stuff with the angle brackets) to be seen by users. A browser/editor would let a user simply view or edit the language of a page of hypertext, as if he were using a word processor. The idea of asking people to write the angle brackets by hand was to me, and I assumed to many, as unacceptable as asking one to prepare a Microsoft Word document by writing out its binary coded format. But the human readability of HTML was an unexpected boon. To my surprise, people quickly became familiar with the tags and started writing their own HTML documents directly. (Berners-Lee & Fischetti, 1999, p. 42)
Linked Data and Issues with RDF

Twenty years ago, Berners-Lee asked people to put their documents on the web and they did. Now, Berners-Lee (2009) is urging everyone to put their data on the web in an effort that he calls linked data. How linked data is different from the notion of semantic web is not perfectly clear. The public may be inclined to interpret “linked data” as simply a rebranding of the term “semantic web” which is burdened with the connotation of being a technology that never got off the ground. But technology consultant Greg Boutin (2009) argues that linked data is a part of the semantic web. It is an effort to open up a vast amount of data currently stored in closed and inaccessible systems without necessarily describing it with much semantics yet. Once enough data is opened up and available on the web, further efforts like ontology engineering could ascribe detailed semantics to the data (DuCharme, 2008). Without getting burdened in technicalities, linked data can be described as a step on the way to the semantic web.

The problem surrounding the adoption of RDF is not merely technology-based. It has to do with people. Taking the World Wide Web as a reference point, the collective benefits of the semantic web might be immense. Already, several examples ambitiously attempt to harness the power of RDF. One of them is Freebase (http://freebase.com), “a public repository of the world’s knowledge” (Bollacker, Evans, Paritosh, Sturge, & Taylor, 2008, para. 1). Another is Twine (http://twine.com), a “part bookmarking tool, part social network, and part recommendation engine, helping users collect, manage, and share online information” (Naone, 2008, para. 2). Asking web designers and developers at large to learn a new technology and create new files and data feeds of existing content based on that new technology might be unrealistic. RDF and technologies derived from it such as RDFa (a set of extensions for embedding RDF into HTML) are undeniably part of the future of the web. It is becoming clearer, however, that the journey to a web of intelligent agents may be long and that there are substantial benefits to be reaped by simpler tools, built on existing technologies, acting on most common and well-defined types of data.
CHAPTER II
MICROFORMATS

Microformats are one of the ways in which semantics can be embedded into HTML documents with minimal effort on the part of the web authors. While RDF, described in Chapter I, assumes that data for humans and data for machines are provided in two different places, microformats assume that data is described in machine-understandable form whenever it is provided for human use. According to Microformats.org, a community devoted to establishing microformat standards:

Designed for humans first and machines second, microformats are a set of simple, open data formats built upon existing and widely adopted standards. Instead of throwing away what works today, microformats intend to solve simpler problems first by adapting to current behaviors and usage patterns (para. 1). In addition, Microformats community defines microformats in terms of what they are not: “A new language; Infinitely extensible and open-ended; An attempt to get everyone to change their behavior and rewrite their tools” (para. 3).

Microformats are perhaps most easily explained through an example. A simple problem that many who browse the web frequently face is extracting contact information or calendar events from a web page and saving the information on one’s personal computer. In a common scenario, the user visits a web page with the intention to obtain Jonathan Johnson’s contact information and store it in their address book. Typically, one selects Jonathan’s email address on the web page, copies it, switches to the address book application, pastes the email address into the appropriate field, and repeats this process for as many times as there are different pieces of information (i.e. phone, fax, each line of the address block, etc.). In the case of phones and portable computing devices that may or may not support copy and paste, one would have to retype all the contact information. If the author of the page in question had implemented microformats, one could download all the contact information into the local address book automatically, with fields correctly preserved. In fact, Jeremy Keith (2007), author and web developer, demonstrated that a transfer of event information from his personal laptop to his
mobile phone can be done with hCalendar through only a few clicks. hCard and hCalendar are evidence that microformats do not have to be extensible or deliver sophisticated automation to be useful.

An Elemental Microformat

Microformats are not a technology per se. Instead, “they are an approach to solving the important problem of creating rich semantic markup for today’s Web” (Allsop, 2007, p. 6). In this capacity, microformats rely solely on standard HTML. Technically speaking, microformats are little more than a standardized set of class names to be used with any appropriate HTML tag. Differences in the markup between a page that does not describe data with microformats and a page that does are not extensive. For example, the Cleveland Museum of Art (http://clevelandart.org) features a mailing address on their web site which is not described with microformats (Figure 2). If the address was to be described with microformats, changes in the HTML markup would be modest and there would be no difference in the appearance of the address as seen in the browser (Figure 3).

Figure 2. An address on the Cleveland Museum of Art web site. This address does not employ microformats. The left side shows how the address is rendered in the browser window. The right side shows how the address is currently marked up in HTML. Image on the left © 2009 The Cleveland Museum of Art.

```
<Address>
  11150 East Blvd
  Cleveland Ohio
  44106
</Address>
```

Figure 3. An address on the Cleveland Museum of Art web site revised to include the Adr-microformat. The appearance in the web browser stays the same. Text in bold represents the elements which constitute the Adr-microformat. Image on the left © 2009 The Cleveland Museum of Art.

```
<Address adr="">
  11150 East Blvd
  Cleveland Ohio
  44106
</Address>
```
In Figure 3, the keyword “adr” (besides the existing “paddingRight”) has been added as a value of the class attribute on the element which contains the address information, in this case a list item. This signifies that the *Adr-microformat* is being used in this document, and that specific address information, such as *street-address*, *locality*, *region*, and *postal-code*, follows inside. Of course, multiple elements on a webpage can have a `class="adr"` attribute, depending on how many addresses are listed. It should also be noted that specific class names can be used on a variety of elements in the markup. The *Adr-microformat* specification (2009) is not restrictive in terms of which HTML elements must or must not contain a particular class as long as they are valid HTML elements. In the example above, the existing list item element provides a convenient hook for the “adr” class, but it could have been inserted into a paragraph, a headline, or a generic `<div>` element as well. If no elements exist that can be used as hooks to describe the data, generic elements such as `<span>` or `<div>`, which will not necessarily effect the appearance of the layout, can be added like is shown in Figure 3.

*Adr-microformat* thus consists of the following elements:

- `post-office-box`
- `extended-address`
- `street-address`
- `locality`
- `region`
- `postal-code`
- `country-name`

The way the markup in Figure 3 is constructed is an example of the *Class-design* pattern. *Class-design* pattern means that an element can be assigned to any HTML tag in the markup via its class name. The example shows that each piece of data such as “Cleveland” is presented only once. It is both rendered on the screen for users to see, and wrapped in an element containing `class="locality"` which tells machines that the locality is Cleveland. A start date for an event could similarly be described using a *Class-design* pattern:

```html
<span class="dtstart">2009-11-13</span>
```

This both renders “2009-11-13” on the screen and describes it as a start date to the machines using `class="dtstart"` attribute. However, “2009-11-13” is not a format in which people typically exchange dates. The date format can have a wide variety of variations which most of us
take for granted. In the United States, “November 13th 2009” or “11/13/09” may be more common while in Latin America, the equivalent is “13/11/09” or “13. 11. 2009.” In fact, if the date was context-dependent, the author may wish to say “this Friday” instead of using any numerical format. “This Friday” may be perfectly clear to a reader who knows the context, but it is impossible for a machine to process. When it is desirable to present the information in an alternative format to what is machine-processable, the Abbr-design pattern can be used instead of the Class-design pattern. The example becomes:

```html
<abbr class="dtstart" title="2009-11-13">This Friday</abbr>
```

Both examples are equivalent and both are a valid way to use specific microformats. Different microformats may employ different design patterns.

In reviewing the list of elements that belong to the Adr-microformat, it is obvious that full contact information cannot be described using this microformat, since it only deals with address elements and does not allow one to relate an address to a person or a company and specify additional contact information such as phone numbers, email addresses, etc. This is because Adr-microformat is a subset of a more comprehensive microformat called hCard, which is intended to describe full contact information. Adr-microformat is called an elemental microformat and hCard is called a compound microformat. Other elemental microformats and their descriptions and definitions are shown in Table 1.
<table>
<thead>
<tr>
<th>Microformat</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rel-enclosure</td>
<td>Indicates that a media file being linked to is intended to be downloaded and cached</td>
<td><a href="http://microformats.org/wiki/rel-enclosure">http://microformats.org/wiki/rel-enclosure</a></td>
</tr>
<tr>
<td>Rel-license</td>
<td>Indicates that the destination of a hyperlink is a license for the current page</td>
<td><a href="http://microformats.org/wiki/rel-license">http://microformats.org/wiki/rel-license</a></td>
</tr>
<tr>
<td>Rel-nofollow</td>
<td>Indicates that the destination of a hyperlink should not be afforded any additional ranking by search engines</td>
<td><a href="http://microformats.org/wiki/rel-nofollow">http://microformats.org/wiki/rel-nofollow</a></td>
</tr>
<tr>
<td>Rel-tag</td>
<td>Indicates that a destination of a hyperlink is an author-designated tag for the current page or part of it</td>
<td><a href="http://microformats.org/wiki/rel-tag">http://microformats.org/wiki/rel-tag</a></td>
</tr>
<tr>
<td>Vote Links</td>
<td>Indicates agreement or disagreement with a destination of a hyperlink primarily on indexing and tracking applications</td>
<td><a href="http://microformats.org/wiki/vote-links">http://microformats.org/wiki/vote-links</a></td>
</tr>
<tr>
<td>XFN</td>
<td>Represents human relationships using hyperlinks</td>
<td><a href="http://gmpg.org/xfn">http://gmpg.org/xfn</a></td>
</tr>
<tr>
<td>XMDP</td>
<td>Defines HTML meta data profile</td>
<td><a href="http://gmpg.org/xmdp">http://gmpg.org/xmdp</a></td>
</tr>
<tr>
<td>XOXO</td>
<td>Defines simple and embeddable format for outlines</td>
<td><a href="http://microformats.org/wiki/xoxo">http://microformats.org/wiki/xoxo</a></td>
</tr>
</tbody>
</table>

Table 1. Elemental microformats.

Elemental microformats, according to the microformats community, are “a minimal solution to a single problem, built from standard XHTML elements ... designed to be incorporated within webpages, and to act as a building block for larger compound microformats” (Elemental, para. 1).

A Compound Microformat

Compound microformats are built from elemental microformats and they typically integrate multiple data types. hCard is an example of a compound microformat. hCard is intended to represent people, companies, and organizations and is most commonly used to describe contact information. Figure 4 is an example of using the hCard microformat to represent a fictional person and their contact information.
Figure 4. Basic contact information of a fictional person described with the hCard microformat. The right side shows how the information could be marked up to use hCard and the left side shows how the information might be rendered in a web browser. Parts of the markup are omitted for brevity. Photo-illustration by Flickr user Planetina.

The elemental Adr-microformat is open-ended in the sense that no element is strictly required. It is not even mandatory that a complete address be used. A markup of a sentence like

```html
<p class="adr">The rain was heavy in <span class="locality">Kent</span> today.</p>
```

is a legitimate use of the Adr-microformat. hCard in comparison is just slightly more prescriptive. The only required element (besides the root vcard) is the name of the person or the entity. Name is indicated by the fn (formatted name) element as is the case in Figure 4. When formatted name is used, it is assumed that the space separates the first name from the last name (in that order) unless there is a comma between the two names in which case it is assumed that the last name is before the comma and first name after it. Machines are supposed to infer the pieces of the formatted name if it resembles the format of “Jonathan Johnson” or “Johnson, Jonathan.” If, however, there are more than two names, or multiple prefixes or suffixes, or we wish to format the name in an unusual way, the n element should be used instead of the fn element. In that case, it becomes necessary to describe each name, prefix, or suffix with an additional element. With the n element, no inference takes place because each piece is explicitly described.

Jonathan's name from Figure 4 could be alternatively marked up in the following way:
It is slightly more verbose but means the same.

The complete element set for the hCard microformat (Table 2) contains a number of elements and subelements.

<table>
<thead>
<tr>
<th>Element</th>
<th>Subelements</th>
<th>Element</th>
<th>Subelements</th>
</tr>
</thead>
<tbody>
<tr>
<td>fn</td>
<td></td>
<td>nickname</td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>family-name, given-name, additional-name, honorific-prefix, honorific-suffix</td>
<td>note</td>
<td></td>
</tr>
<tr>
<td>adr</td>
<td>post-office-box, extended-address, street-address, locality, region, postal-code, country-name, type, value</td>
<td>org</td>
<td>organization-name, organization-unit</td>
</tr>
<tr>
<td>agent</td>
<td></td>
<td>photo</td>
<td></td>
</tr>
<tr>
<td>bday</td>
<td></td>
<td>rev</td>
<td></td>
</tr>
<tr>
<td>category</td>
<td></td>
<td>role</td>
<td></td>
</tr>
<tr>
<td>class</td>
<td></td>
<td>sort-string</td>
<td></td>
</tr>
<tr>
<td>email</td>
<td>type, value</td>
<td>sound</td>
<td></td>
</tr>
<tr>
<td>geo</td>
<td>latitude, longitude</td>
<td>tel</td>
<td>type, value</td>
</tr>
<tr>
<td>key</td>
<td></td>
<td>title</td>
<td></td>
</tr>
<tr>
<td>label</td>
<td></td>
<td>tz</td>
<td></td>
</tr>
<tr>
<td>logo</td>
<td></td>
<td>uid</td>
<td></td>
</tr>
<tr>
<td>mailer</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Full element set of the hCard microformat.

Microformats Principles

Several of these elements such as agent, which “specifies information about another person who will act on behalf of the entity represented by the hCard” or mailer, which “specifies the type of electronic mail software that is used by the entity represented by the hCard,” etc. will most likely be rarely used on the web (Allsop 2007 p. 298). These elements are a part of the hCard specification because hCard is derived directly from the older and popular file format called vCard and standardized by the Internet Engineering Task Force (IETF) in RFC 2426.
vCard is a file format used to store and exchange contact information on personal computers and is popularly used by the Address Book application on Apple’s Mac OS, both the Contacts and Outlook applications on Microsoft Windows, and the Evolution and Kontact applications on Linux.

The fact that hCard is a literal and complete translation of the vCard format into HTML demonstrates another important philosophy of microformats. They are “adapted to the current behaviors and usage patterns” (Microformats, para. 2). Employing existing element names in microformat proposals provides several benefits. Authors that may be familiar with existing tools do not need to learn yet another vocabulary of metadata. It becomes easier for web developers to allow users to acquire and use data found on the web. It also becomes easier for popular desktop applications to export web pages or syndication feeds that contain a microformat. This is the case with both the hCard and hCalendar microformats. For many other microformats, there is no widely adopted file format but it is still possible and desirable to standardize the most common practices and element names used by web authors. Existing compound microformats are shown in Table 3.

<table>
<thead>
<tr>
<th>Microformat</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>hCard</td>
<td>Contact information for people and organizations</td>
<td><a href="http://microformats.org/wiki/hcard">http://microformats.org/wiki/hcard</a></td>
</tr>
<tr>
<td>hCalendar</td>
<td>Calendar events</td>
<td><a href="http://microformats.org/wiki/hcalendar">http://microformats.org/wiki/hcalendar</a></td>
</tr>
<tr>
<td>hReview</td>
<td>Reviews of products, services, businesses, events, etc.</td>
<td><a href="http://microformats.org/wiki/hreview">http://microformats.org/wiki/hreview</a></td>
</tr>
<tr>
<td>xFolk</td>
<td>Collections of bookmarks</td>
<td><a href="http://microformats.org/wiki/xfolk">http://microformats.org/wiki/xfolk</a></td>
</tr>
</tbody>
</table>

Table 3. Compound microformats.

Microformats Development Process

In the tradition of early and present-day RFCs, the microformats development process is neither centralized nor authoritarian (Crocker, 2009). In practice, it may seem chaotic or at least a bit wayward. Microformats are developed by a community of inclined individuals using a wiki (web-based software designed for collaboration) on the microformats web site (http://microformats.org). Creating an account on the wiki is free and open to anyone. Allsopp (2007)
notes that any new microformat proposal needs to follow a process which is based on core principles underpinning microformats, namely:

- Solve a specific problem
- Start as simply as possible
- Are designed for humans first, machines second
- Reuse building blocks from widely adopted standards
- Are modular and embeddable
- Enable and encourage decentralized development, content, and services (p. 274)

The process itself consists of four stages shown in Figure 5, which illustrates the iterative nature of the first three stages (Process, 2009). Once a draft standard has been labeled a standard proper, it is not expected to change.

![Figure 5. Microformats development process. (http://microformats.org/wiki/process)](http://microformats.org/wiki/process)

Determining the problem is a prerequisite for proposing a new microformat. Once a problem has been identified and confirmed, the research phase is usually documented on an examples page for that particular proposal on the wiki. Two more pages, the formats page and brainstorming page, are also usually created with the intention to document potential existing formats or standards that deal with similar data and to facilitate the discussion among members. As needed, a number of additional pages may be created on the wiki for any particular proposal. Those may include the FAQ page, issues page, and implementation page (Process, para. 34). Once a consensus among members is reached about a particular proposal, authors create a draft specification. A draft specification defines and explains a particular microformat in a complete form. While a draft specification is complete, it may change, and it is assumed that anybody interested in implementing a microformat based on it should check back for any potential changes. Once a number of tools that take advantage of a particular microformat have been built and no significant issues have been identified in the process, draft specification
generally becomes a standard, which is not expected to change further. The timeframe for this step like all other steps is not fixed. Rather, momentum and community consensus generally define the stages of the development process.

**Applications and Benefits**

Upcoming (http://upcoming.org) is a web site that hosts details about upcoming events. Users can post and track events in local areas, and build communities by letting other people know they will attend. The web site was acquired by Yahoo in 2005 and uses hCalendar to mark up the event information. This enables developers to easily allow the public to download event information to their calendaring applications on their personal computers or portable devices without additional effort.

Cork’d (http://corkd.com) is a social networking web site for wine lovers. It allows its members to track wines they have tasted, wines they own, and wines they would like to buy, as well as share notes and recommendations and discover new wines in a fun and friendly way. Cork’d uses the hReview microformat to mark up users’ wine reviews, hCard microformat to mark up users’ personal details, and XFN microformat to mark up the relationships between users of the web site. Dan Cederholm, one of the creators of Cork’d explains the benefits of using microformats that hint at the potential of semantic data. Although Cork’d has no official application programming interface (API), microformats implemented function as one:

> I think it’s the unexpected benefits that are the most exciting. For example, a developer contacting me saying that he’d scraped the XFN’d contact list, then the hReviews, ran everything through a SPARQL engine that could generate a list of reviews only from his trusted friends. Now this would be a great feature to have as a part of Cork’d—but the beautiful thing is that this guy was able to build it himself using microformatted data that was revealed on Cork’d. I have to admit I had no idea what he was talking about—and that’s fantastic! I’m calling this oblivious development—that I as an interface designer can choose to use microformats, and then people who actually know what they’re doing can come along and do really cool stuff with the data. (Allsopp, 2007, p. 243)

While hCard has been discussed in some detail to provide a sense of how microformats function, it is beyond the scope of this thesis to discuss every microformat and its usage. Table 1
and Table 3 list the existing elemental and compound microformats and provide URIs to their specifications or draft specifications. There are more microformats beyond elemental and compound ones listed here. The index of all microformats, along with specifications or draft specifications, can be accessed at the Microformats wiki (http://microformats.org/wiki). This page is a definitive resource for a more detailed investigation.
Revealing the Inaccessible

Environmental graphic designer Miranda Hall-Carrier (2008) suggests that museums have seen their web sites mostly as marketing tools and sources of pre-visit information. Hall-Carrier, however, observes that

museums have learned that there are other additional opportunities [offered by] the museum site beyond trip planning. For instance, the number of museums displaying and interpreting their collection online is growing. This allows the museum to extend their reach geographically and provide visitors with more opportunities to learn before or after the visit, and thus can further build a relationship between museum and individual. (p. 25)

The significance of providing access to a museum’s collections on the web becomes more apparent in the light of the fact that only a few percent of museums’ collections are on display at any given time. While the items on display rotate constantly, the average ratio of work on display in museums in the United States is between one and three percent (Aspinwall, J. & Fox Knappe, S., personal communication, August 13, 2009). Beyond allowing the museum to extend its reach geographically, access to the collection on the web has obvious benefits for art historians, other educators, and the general public.

Museums can currently take advantage of many existing general-purpose microformats to describe more of their data in a semantic way. For example, hCalendar could be used to mark up information about all past, current, and upcoming exhibitions and other events. This would allow the public as well as museum staff to easily subscribe to or download event dates and details to their personal computers and portable devices. Likewise, hAtom could be used to describe episodic content if the museum site features a weblog or news feed. If the web site features downloadable podcasts, Rel-enclosure could be used to cache the video or audio content, when and if appropriate. Museums are increasingly implementing folksonomies, or collaborative user-generated tags, to describe artwork in their collections (Pink, 2005). Rel-tag is an exceptionally simple microformat derived specifically from this practice. If a museum
provides detailed license information on pages that feature items from their collections, Rel-
license can be used to mark up a hyperlink that is a license to a respective item. And of course,
hCard can be used to mark up information on contact pages. All of these microformats are not
limited to any particular kind of application. They can be deployed across a range of web sites. It
is their versatility that makes them useful on an art museum’s web site. But one kind of
information that is both specific to art museums and central to their existence remains
problematic to describe in a semantic manner on the web—works of art themselves.

Adding semantics to works of art on the web is complex and problematic. The
microformat proposed in this thesis is a solution to this complexity. This chapter will
demonstrate that information about visual artwork is both in common usage and relatively
standardized. These two attributes are important because they signify that information about
visual art, communicated through artwork labels, is well suited to be described by a structured
Visual Art microformat.

Research

The labeling practices of four museums have been documented both offline (on museum
walls and in print) and online. The museums are the Nelson-Atkins Museum of Art in Kansas
City, Missouri, which accommodates 13 collections and over 33,500 works of art (Nelson-
Atkins, 2009); The Cleveland Museum of Art in Cleveland, Ohio, which accommodates 19
collections and over 43,000 works of art (Cleveland, 2009); The Akron Art Museum in Akron,
Ohio, which accommodates two collections of over 4,000 works (Tunstall, A., personal
communication, October 9, 2009); and The Kemper Museum of Contemporary Art in Kansas
City, which accommodates a collection of contemporary art of roughly 1,000 works (Bingaman,
R., personal communication, August 14, 2009). In addition, interviews have been conducted
with the Assistant Curator of American Art and the Assistant Curator of Photography at the
Nelson-Atkins, the Associate Registrar at the Kemper, the Director of Curatorial Affairs, the
Collections Manager, and the Chief Preparator at the Akron Art Museum, and the Curator of
African Art at the Cleveland Museum of Art.
Figures 6 through 9 show the typical labeling practice inside the four museums.

Figure 6. *Mont-Sainte-Victoire*, ca. 1902-06 by Paul Cézanne next to its label at the Nelson-Atkins Museum of Art.

Figure 7. *Water Lilies*, 1919-26 by Claude Monet next to its label at the Cleveland Museum of Art.
Figure 8. **Bordner Mural**, 1936-37 by William Sommer next to its label at the Akron Art Museum. Painting image provided by OhioLink Digital Resource Commons (DRC). Label Image provided by the Akron Art Museum.

**William Sommer**  
American, born 1867, Detroit; died 1949. Northfield Center, Ohio  
**Edwin Sommer**  
American, born 1899, New York; died 1957. Sacramento, California

A collaboration between Sommer and his son Edwin, this painting was commissioned by Ruth Bordner as a birthday present for her husband Robert, a newspaper writer and close friend of the Sommers. The image probably represents the rural property that the Bordners owned in nearby Peninsula, Ohio. Sommer received several commissions during his career, including some for federal government art projects during the Great Depression. When working on commissions, he tended to paint in a more refined style, with quieter colors and defined shapes.

Collection of the  
Akron Art Museum,  
Gift of  
Robert Bordner  
1973.27

Figure 9. **Rising Sun**, 1958 by Hans Hoffmann next to its label at the Kemper Museum of Contemporary Art.

**Hans Hoffmann**  
Born 1902 in Wiesenburg, Germany  
Died 1988 in New York, New York  
**Rising Sun**, 1958  
oil on canvas  

Beba and Crosby Kemper Collection  
Some commonalities are rather apparent. All of the four labels contain the artist’s full name, title of the work, year of completion or years during which the artwork was created, and media used to create the work. These pieces of information are referred to as “tomb stone info” in the museum community. All four examples also identify which funds were used in the acquisition (or who gifted the piece) and include the accession number, which serves as a unique identifier for the artwork. Where the four labels differ is in the number of details about the artist and whether the didactic text is present on the label or not. In three of four examples, the artist’s nationality is given, along with years of birth and death, and in two of the four examples, places of birth and death are also provided. Finally, one of the four examples features the audio tour number on the label. The Cleveland Museum of Art also provides audio tours, although this is not featured in Figure 7.

Curator interviews reveal that label configuration and especially the didactic text are at the discretion of a curator. While some curators have dissenting opinions on whether didactic text should be present on all labels in the museum or on any for that matter, most interviewed agree that the long-term goal for their institution is to have a didactic label on all the works in their collections. Similar is the case with audio tours. Two of the four museums currently offer audio tours and thus include the audio tour number on the labels. The two smaller museums are not currently offering audio tours for items in their permanent collections. Due to cost concerns, they are either in the process of considering alternatives or options to implement them in the future given enough resources. Curators interviewed stressed that the credit line (which specifies the funds used) always accompanies the artwork whenever it is displayed or reproduced by the museum. The Institutions see showing the credit line as an implicit obligation towards those who have made the purchase possible or gifted the piece.

When asked if they feel that label information is relatively standardized across museums, five out of seven museum professionals replied in the affirmative. Two museum professionals were cautious about providing a categoric answer but agreed that attempts are underway to get the label information standardized or that in general, labels are getting increasingly standardized. All interviewed qualified this as a positive and a desirable development. It is important to note that the museum professionals who saw differences between the labeling practices across museums focused primarily on the style of the labels i.e. whether the artist or
the work title was shown first or second, how long the didactic text is, and how the lines break. Also noted were the differences in the visual hierarchy of the labels. But, there was little disagreement about which elements are customarily present on the labels and which are not.

Review of the printed material (gallery guides, promotional pieces, postcards, publications) shows that the material produced by the museums generally follows the same pattern as the wall labels. To single out one example, the label on the back of a postcard from the Cleveland Museum of Art reads:

*Nataraja: Siva as King of Dance.* Bronze, h. 111.5 cm. India, Chola period, 11th century. Purchase from the J. H. Wade Fund, 30.331 © 1991 Cleveland Museum of Art

This example features two common additions found in reproductions of visual art. The physical size of the piece is provided and the institution’s name is also included. These two pieces of information are consistently omitted on the labels next to the artwork to prevent redundancy but are consistently present next to the reproductions in all four museums researched.

Museums that hold works of design and architecture regularly include names of clients, manufacturers, fabricators, engineers, or other significant collaborators along with the names of the designers or the architects. For example:

Charles and Ray Kaiser Eames, designers
*American,* 1907-1978, 1913-1988
Herman Miller Furniture Company, manufacturer
*American,* Zeeland, Michigan, 1923 to present
Side Chair: Model DCW, designed 1945-46, manufactured ca. 1952.
Laminated walnut, walnut-faced plywood, rubber and metal

Does examining labels from museum walls and museum print material make sense when microformats only deal with information that is presented on the web? Would not documenting how respective museums present their collections on the web be a better source material for deciding what should be a part of the microformat? Looking at the markup of respective web sites is certainly necessary but the reason for focusing on the wall labels is twofold. Two of the three museums do not currently have a publicly accessible collection on web. Most importantly, a bulk of the labeling decisions are at the discretion of the curators, and labels on the wall are the most immediate reflection of their intentions and interests.
Interviews indicated that three of the four museums use a collection management system built by the same company. In this context, it could be said that there is at least an oligopoly in the market for art museum collection management software. This is a significant observation because this software typically provides a module which generates the markup and templates used by the publicly accessible web site. The decisions made by a software vendor about which information to display on the web site and how to search for, browse, and display that information most likely can be customized or overridden. The process, however, requires that whichever department deals with the web site become involved. In this sense, an implementation effort required can play a limiting role.

Current Web Practices

The Akron Art Museum, which at the time of the interviews had recently started transferring their collections to a collection management system made by Gallery Systems, does not currently have publicly accessible collections on the web. The Akron Art Museum does, however, have three works of art on their web site which highlight their collections. Figure 10 shows how the label is marked up on one of the three featured works.

![Figure 10: A label on the Akron Art Museum web site (http://akronartmuseum.org). Labels are only visible on mouse hover. The Markup in bold is the text that appears as the tooltip. Left image Copyright © 2007 Akron Art Museum.](http://akronartmuseum.org)

The example in Figure 10 lists the artist, title of the work, date of completion, and the collection. The Nelson-Atkins Museum of Art web site has more than three but fewer than a hundred featured works. Figure 11 shows current labels on the Nelson-Atkins web site.
The example in Figure 11 brings one new element not seen in earlier examples — the location of the piece. Figure 12 shows current labels on the Kemper Museum’s web site.

...
Besides already noted elements, the Kemper Museum adds a classification, copyright notice, and related resources (“Portfolio List”). Figure 13 shows current labels on the Cleveland Museum’s web site.

![Figure 13. A label on the Cleveland Museum of Art web site (http://clevelandart.org). Parts of the markup and image of artwork are omitted for brevity. Left image Copyright © the Cleveland Museum of Art.](image)

The Cleveland Museum of Art web site in most cases offers three different views of the items in their collections: _overview_, _more information_, and _catalogue notes_. The _overview_ displays the image with basic information such as artist, title, date, and accession number. Figure 16 shows the _more information_ view which contains additional details. _Catalogue notes_ shows extensive textual entries about the item. Despite considerable detail, the only item not seen in previous two figures is the department, which in this example is African Art.

**In Summary**

To summarize, all elements used by the four museums in both online and offline communication are shown in Table 4.
<table>
<thead>
<tr>
<th>Element</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artist’s name</td>
<td>If the author is unknown, it is usually omitted or the surrogate information is used in its place such as the tribe’s name and/or region.</td>
</tr>
<tr>
<td>Title</td>
<td>Occasionally, two titles, the source title and the translation, can appear at the same time.</td>
</tr>
<tr>
<td>Date</td>
<td>Date is typically shown in a year-only format. For older pieces, date could be a range of years, century, or the name of the period. Sometimes, curators deem it appropriate to say that the work was completed “before” or “after” a certain date without specifying the second limit on the date range.</td>
</tr>
<tr>
<td>Medium</td>
<td>Defines all media used in the making of the work.</td>
</tr>
<tr>
<td>Dimensions</td>
<td>Dimensions can be given in a variety of formats and units. It is common for two units of measurement to be shown at the same time, <em>e.g.</em> inches and centimeters. There can be one, two, or three dimensions of measurement, and dimension does not necessarily need to be numerical since some art historians may use a verbal description such as “life size.” Sometimes both framed and unframed dimensions are shown at the same time. In the case of time-based media, length may be shown.</td>
</tr>
<tr>
<td>Collection</td>
<td>Collection can be somewhat ambiguous in a sense that smaller museums have fund-related collections, while for the larger museums a collection may be an equivalent to a “department.” In the former case, verbal description will usually begin with “Collection of ...”.</td>
</tr>
<tr>
<td>Credit line</td>
<td>Credit line specifies which funds were used in the acquisition of the work or who gifted the work. Museums appear to be bound to displaying the credit line in any showing, publication, or reproduction of the work.</td>
</tr>
<tr>
<td>Accession number</td>
<td>Unique identifier given to every work by institutions. Museums also seem to be universally consistent in displaying the accession number in any showing, publication, or reproduction of the work.</td>
</tr>
<tr>
<td>Institution</td>
<td>The institution that currently owns the work, <em>e.g.</em> a museum, corporate, or private collection. It is usually omitted in the museum, and on their website, but generally present in publications, and promotional material destined to be used beyond the museum. Institution is also universally present in independent art historical texts.</td>
</tr>
<tr>
<td>Didactic text</td>
<td>Standards on didactic text may vary between institutions. Among the four museums researched, length of the didactic text ranges from 70 words to 150 words for the wall labels. It is also possible that the museum may want to adopt a separate standard for the web.</td>
</tr>
<tr>
<td>Audio tour number</td>
<td>Most museums that do have audio tour numbers apparently do not display them on the web.</td>
</tr>
<tr>
<td>Location</td>
<td>Location of the item inside the museum. This is typically a gallery number, or a notice that the item is not currently on view.</td>
</tr>
<tr>
<td>Copyright notice or license</td>
<td>Copyright notice can be as simple as a line of text or can be a link to a page that describes the rights in more detail.</td>
</tr>
<tr>
<td>Related works</td>
<td>Links to related works.</td>
</tr>
</tbody>
</table>

Table 4. Label elements currently used by museums researched.
CHAPTER IV
VISUAL ART MICROFORMAT SCHEMA PROPOSAL

Related Metadata Sets

Looking at the 14 elements identified in Table 4, it becomes clear that standard HTML elements alone or in combination with one another cannot sufficiently describe the artwork in a semantic way. To stay within the microformats’ development process, it is necessary to look at existing formats and metadata to see whether this problem has already been solved, before proposing a new schema.

Figure Microformat Draft

A draft specification has been developed for a Figure microformat which describes captions for figures, such as the ones found in this thesis (Figure, 2009). Figure microformat is simple and consists of the root element, figure and four additional elements: image, legend, credit, and subject. This microformat is meant to mark up captions such as “A photo of Tim Berners-Lee by Declan McCullagh (photographer)” where the whole quoted phrase is a legend, “Tim Berners-Lee” is the subject, and “Declan McCullagh (photographer)” is the credit, both within the legend. The image element is certainly necessary to describe visual art, but the legend element is obviously not precise enough to describe all the elements identified in Table 4. The subject element from the Figure microformat, as the research shows, is not practical for visual art. If a title of the piece does not already identify the subject, a common practice in the visual art domain is to either describe the subject matter of the piece in greater detail within the didactic text, or alternatively, with tags. Furthermore, the credit element in case of museums means something entirely different, as described in Table 4.

Dublin Core

Dublin Core Metadata Initiative is a popular metadata set with a mission to “provide simple standards to facilitate the finding, sharing and management of information” (DCMI 2009). While Dublin Core is conceived as a generic and core metadata set for a variety of resources including images, the widest adoption of Dublin Core has been among textual
documents. Dublin Core is perhaps the most popular metadata set employed by current RDF applications but Dublin Core can be also used in standard HTML. Table 5 shows a 15-element Dublin Core metadata set.

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>A name given to the resource.</td>
</tr>
<tr>
<td>Creator</td>
<td>An entity primarily responsible for making the content of the resource.</td>
</tr>
<tr>
<td>Subject</td>
<td>The topic of the content of the resource.</td>
</tr>
<tr>
<td>Description</td>
<td>An account of the content of the resource.</td>
</tr>
<tr>
<td>Publisher</td>
<td>An entity responsible for making the resource available.</td>
</tr>
<tr>
<td>Contributor</td>
<td>An entity responsible for making contributions to the content of the resource.</td>
</tr>
<tr>
<td>Date</td>
<td>A date associated with an event in the life cycle of the resource.</td>
</tr>
<tr>
<td>Type</td>
<td>The nature or genre of the content of the resource.</td>
</tr>
<tr>
<td>Format</td>
<td>The physical or digital manifestation of the resource.</td>
</tr>
<tr>
<td>Identifier</td>
<td>An unambiguous reference to the resource within a given context.</td>
</tr>
<tr>
<td>Source</td>
<td>A reference to a resource from which the present resource is derived.</td>
</tr>
<tr>
<td>Language</td>
<td>A language of the intellectual content of the resource.</td>
</tr>
<tr>
<td>Relation</td>
<td>A reference to a related resource.</td>
</tr>
<tr>
<td>Coverage</td>
<td>The extent or scope of the content of the resource.</td>
</tr>
<tr>
<td>Rights</td>
<td>Information about rights held in and over the resource.</td>
</tr>
</tbody>
</table>


While the Dublin Core metadata set is fairly document-centric with elements such as language or publisher, there is a significant overlap with many fields identified in Table 4, such as title, creator, date, identifier, and description. Even though some of the information needed for visual art such as medium, dimensions, and credit line has not been covered, elements that do overlap provide a good basis for nomenclature.
VRA Core

The most comprehensive metadata set related specifically to visual art is the VRA Core metadata set for the cultural heritage community developed by the Visual Resources Association and currently in its fourth version (Visual 2009). Having specifically visual resources in mind, and developed for the museums and other cultural and educational institutions, VRA Core is meant to be implemented specifically in XML. Table 6 shows the exhaustive element set of VRA Core 4.0.

<table>
<thead>
<tr>
<th>Element</th>
<th>Subelements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work, Collection, Image</td>
<td></td>
</tr>
<tr>
<td>Agent</td>
<td>Attribution, Culture, Dates (Earliest Date, Latest Date), Name, Role</td>
</tr>
<tr>
<td>Cultural Context</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Earliest Date, Latest Date</td>
</tr>
<tr>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>Inscription</td>
<td>Author, Position, Text</td>
</tr>
<tr>
<td>Location</td>
<td>Name, RefID</td>
</tr>
<tr>
<td>Material</td>
<td></td>
</tr>
<tr>
<td>Measurements</td>
<td></td>
</tr>
<tr>
<td>Relation</td>
<td></td>
</tr>
<tr>
<td>Rights</td>
<td>Rights Holder, Text</td>
</tr>
<tr>
<td>Source</td>
<td>Name, RefID</td>
</tr>
<tr>
<td>State Edition</td>
<td>Description, Name</td>
</tr>
<tr>
<td>Style Period</td>
<td></td>
</tr>
<tr>
<td>Subject</td>
<td>Term</td>
</tr>
<tr>
<td>Technique</td>
<td></td>
</tr>
<tr>
<td>Textual Reference</td>
<td>Name, RefID</td>
</tr>
<tr>
<td>Title</td>
<td></td>
</tr>
<tr>
<td>Work Type</td>
<td></td>
</tr>
</tbody>
</table>

Table 6. VRA Core 4.0 metadata element set (http://vraweb.org/projects/vracore4/VRA_Core4_Element_Description.pdf). Element descriptions and element attributes are omitted for brevity.
For example, description of the material element from VRA Core might look like the following in its XML form (VRA, 2007, p. 18):

```xml
<materialSet>
  <display>oil paint on canvas</display>
  <material type="medium" vocab="AAT" refid="300015050">oil paint</material>
  <material type="support" vocab="AAT" refid="300014078">canvas</material>
</materialSet>
```

VRA Core embraces the paradigm of separating the display information ("oil paint on canvas") from the meaning (defined by two material elements, each of different type). Attributes integrate the use of controlled vocabularies specific to the domain such as the Union List of Artist Names (ULAN), Getty Thesaurus of Geographic Names (TGN), or Art and Architecture Thesaurus (AAT) which is used in the example above and which explicitly defines the meaning of each element. The VRA Core metadata set is an excellent choice of metadata for collection management systems that generate records and rely on controlled vocabularies. VRA Core, however, suffers from the same problem as RDF, namely complexity. The Akron Art Museum for example experimented with implementing the VRA metadata set into their internal processes but ultimately found that it did not fit their needs (Tannenbaum, B., personal communication, September 17, 2009). Unlike with Dublin Core, there is no way for web authors to easily embed this metadata inside their existing HTML documents.

**The Proposal**

The Visual Art microformat addresses this spectrum between the exceedingly simple Figure microformat (which can be easily implemented inside existing HTML documents but offers an insufficient level of semantic richness) and the VRA Core metadata set (which accommodates even the most demanding levels of semantic granularity but cannot be embedded into existing HTML documents). Table 7 lists the elements of the proposed Visual Art microformat.
<table>
<thead>
<tr>
<th>Element Name</th>
<th>Definition and Notes</th>
<th>Restriction</th>
</tr>
</thead>
<tbody>
<tr>
<td>vart</td>
<td>Root element for the Visual Art microformat.</td>
<td>‡</td>
</tr>
<tr>
<td>image</td>
<td>Image of the work being described. If only one HTML image tag is present within the root, <em>image</em> element can be omitted.</td>
<td>†</td>
</tr>
<tr>
<td>fn, n, org</td>
<td>Name of the creator. It is interpreted identically to <em>fn</em>, <em>n</em>, and <em>org</em> elements in <em>hCard</em>. If <em>fn</em> is used, inference may take place. If <em>n</em> is used, allowed subelements are <em>family-name</em>, <em>given-name</em>, <em>additional-name</em>, <em>honorific-prefix</em>, <em>honorific-suffix</em>. In case of organizations as authors or contributors, both <em>org</em> and <em>fn</em> are used to describe the name. It is recommended that authors use the Union List of Artist Names (ULAN) controlled vocabulary.</td>
<td></td>
</tr>
<tr>
<td>contributor</td>
<td>Name of the contributor in creation of the work. Allowed subelements are <em>fn</em> and <em>n</em>, which are interpreted identically as in <em>hCard</em>.</td>
<td></td>
</tr>
<tr>
<td>title</td>
<td>Title of the work.</td>
<td>‡</td>
</tr>
<tr>
<td>date</td>
<td>Date of creation. Unlike with <em>hCard</em>, date is parsed as text and <em>Abbr-design</em> pattern is not used.</td>
<td>*</td>
</tr>
<tr>
<td>medium</td>
<td>Media used in the creation of the work. It is recommended that authors use the Art and Architecture Thesaurus (AAT) controlled vocabulary.</td>
<td>*</td>
</tr>
<tr>
<td>measurements</td>
<td>Dimensions of the work. Like the <em>date</em> elements, it is parsed as text.</td>
<td>*</td>
</tr>
<tr>
<td>collection</td>
<td>Collection that the work belongs to.</td>
<td>*</td>
</tr>
<tr>
<td>credit</td>
<td>Credit or acknowledgment given by the institution.</td>
<td></td>
</tr>
<tr>
<td>identifier</td>
<td>Institution’s unique identifier for the work. Typically the accession number.</td>
<td>*</td>
</tr>
<tr>
<td>institution</td>
<td>Name of the institution holding the work.</td>
<td>*</td>
</tr>
<tr>
<td>description</td>
<td>Didactic text that describes the work.</td>
<td>*</td>
</tr>
<tr>
<td>audio-tour</td>
<td>Audio tour number for the work.</td>
<td>*</td>
</tr>
<tr>
<td>location</td>
<td>Location of the work within the institution.</td>
<td>*</td>
</tr>
<tr>
<td>license</td>
<td>Information about rights held in and over the resource. Must use existing <em>Rel-license</em> microformat, implementing the <em>Rel-design</em> pattern.</td>
<td>*</td>
</tr>
<tr>
<td>tag</td>
<td>Information about related works or resources. Must use existing <em>Rel-tag</em> microformat, implementing the <em>Rel-design</em> pattern.</td>
<td></td>
</tr>
<tr>
<td>adr</td>
<td><em>Adr-microformat</em> can be used arbitrarily within the root element. It is recommended that authors use Getty Thesaurus of Geographic Names (GTGN) controlled vocabulary.</td>
<td></td>
</tr>
<tr>
<td>geo</td>
<td><em>Geo-microformat</em> can be used arbitrarily within the root element.</td>
<td></td>
</tr>
</tbody>
</table>

Table 7. Elements and definitions of the proposed Visual Art microformat. ‡ Element must be present only once. † Element must be present at least once. * Element must not be present more than once. Elements with no restriction can be absent or present multiple times.
The markup patterns documented on museum web sites in examples found in Chapter III consisted of generic HTML elements and did not offer any basis for a potential nomenclature by reusing existing HTML class names or “id” attributes. The element nomenclature shown in Table 7 is based on a combination of existing microformats (e.g. image, n, fn, tag, license, etc.), domain jargon (e.g. medium, collection, credit, audio-tour), and existing related metadata such as Dublin Core and VRA Core (e.g. title, date, measurements, identifier, description, location).

Notably, information about the creator such as nationality or dates of activity, documented in earlier examples, is omitted. The first reason for the omission is that information about the creator is too complex. Many artists have had multiple nationalities, and their cultural origin may be different from a cultural context in which the work has been created. Frequently, curators make editorial decisions about what information is relevant in each particular case. VRA Core, being a comprehensive metadata set, is capable of dealing with differences in nuance by allowing a good degree of extensibility when dealing with nationalities and cultures. For a microformat, which by definition is not intended to be extensible nor comprehensive, this complexity is detrimental. Second, the focus of the Visual Art microformat is to describe the artwork. Information about artists should be covered in a separate microformat which can serve as a basis for a compound Visual Art microformat. The n and fn properties are, for this reason, taken directly from hCard. Full hCard microformat should not be embedded into Visual Art microformat because artwork labels are not meant to communicate artists’ contact information. While there may be some utility in being able to treat the names of living artists as contacts in one’s address book, the sheer volume of artists throughout history might make the hCard detection tools overcrowded with little apparent utility in treating the names as contact information and being able to extract it. Existing codebase for parsing and inference, however, is a valuable resource and it should not simply be ignored. Thus, using the elements of hCard but omitting the “vcard” root element is the best possible compromise.
Markup Examples

The label documented in Figure 10 could be marked up in the following way using the proposed microformat:

```html
<p class="vart">
  <span class="fn">William Somner</span>,
  <span class="title">Landscape with Yellow clouds</span>,
  <span class="date">around 1915</span>.
  <span class="collection">Collection of the Akron Art Museum</span>
</p>
```

The label documented in Figure 11 would become:

```html
<div class="vart">
  <img src="..." alt="..." />
  <p><span class="fn">Claude Monet</span>, French, 1840–1926<br />
     <span class="title">Boulevard des Capucines</span>,
     <span class="date">1873–1874</span><br />
     Foreign Title:<br />
     <span class="title" lang="fr">Les Grands Boulevards</span><br />
     <span class="medium">Oil on canvas</span><br />
     <span class="measurements">Unframed: 31 5/8 x 23 3/4 inches (80.33 x 60.33 cm) Framed: 43 3/8 x 36 1/4 x 4 inches (110.17 x 92.08 x 10.16 cm)</span><br />
   </p>
   <p><span class="credit">Purchase: the Kenneth A. and Helen F. Spencer Foundation Acquisition Fund</span>,
     <span class="identifier">F72–35</span></p>
   <p class="location">Location: Gallery P31</p>
   <p class="description">Today, we view this...</p>
</div>
```

Finally, for the most involved of all examples, the label documented in Figure 13 would become:

```html
<div class="vart">
  <img src="..." alt="..." />
  Title: <span class="title">Head</span><br />
  Maker: <span class="adr">Africa, <span class="locality">Nigeria</span>, <span class="region">Nok region</span></span>, 7th century BC–3rd century AD<br />
  Medium: <span class="medium">terracotta</span><br />
  Measurements: <span class="measurements">Overall: 38.2cm x 20cm</span><br />
  Date: <span class="date">c. 600 BC–AD 250</span><br />
  Acquisition: <span class="credit">Andrew R. and Martha J. Fund</span><br />
  Location: <a class="location" href="...">Not on display</a><br />
  Accession Number: <span class="identifier">1995.21</span><br />
  Department: <a class="collection" href="...">African Art</a><br />
  <p>See Also:</p>
</div>
```
As the preceding examples demonstrate, it is possible to easily embed lightweight semantics by marking up all elements of label information identified in the research with the proposed Visual Art microformat and standards compliant HTML. The proposed microformat, much like any other existing microformat, is neither comprehensive nor extensible. It cannot be expected to cover atypical and edge cases. However, given its capacity to describe a vast majority of the collections of four museums that are as varied in size and focus as the four researched, the majority of the collections across museums could be described semantically without new languages, internal workflow changes, or extensive effort.
CHAPTER V
A LOOK AHEAD

Potential Applications

In some respects, designing a specification of any sort is similar to type design. Type designers design typefaces which others use in order to create content of interest for larger audiences or the general public. A design of a typeface can be inspired by a specific application and fine-tuned to fit it but there is little type designers can do to enforce the typeface being used solely for the intended application. A great deal of typefaces have been designed without preconceived applications in mind. They are simply a source material for the work of others which doubtlessly may surprise and delight the original creator.

As the history of both the web and the Internet demonstrates, it is hard to predict what types of applications may be enabled by a certain standard or what kinds of tools may be built to take advantage of a certain architecture. It is not the purpose of this thesis to enumerate all potential applications of the proposed Visual Art microformat. Still, it is possible to point at broad kinds of potential applications that may take advantage of it.

Better Search

Despite Google's current dominance among search tools on the web, subject-specific search engines such as Octopart (http://octopart.com), a search engine solely for electronic parts, have an enormous potential in bringing in more relevant search results. Even within Google, subject-specific initiatives are taking place such as Google book search (http://books.google.com), Google patent search (http://google.com/patents), Google product search (http://google.com/products), Google finance (http://google.com/finance), Google scholar search (http://scholar.google.com), and Google audio indexing (http://google.com/gaudi) to name a few. Many search engines are starting to employ semantic search technologies in the way they calculate the search rankings and enhance the search results. Yahoo pioneered the use of hReview in its search results to feature a collective rating of products and services (Allsopp, 2007, p. 216). Google, among others, is now also employing hReview for the same purpose (Goel, Guha, & Hansson, 2009). With the introduction of the Bing search engine, Microsoft
has begun employing structured data sets from Freebase for displaying the info boxes which let users “see a quick summary of what they are looking for, complete with images and important facts” (Freebase, 2009, p. 2).

All seven museum professionals interviewed agreed that they would find a search engine dedicated exclusively to visual art useful. Two of seven thought that similar tools already existed, namely the ArtStor (http://artstor.org), a fine art image database, or Google image search. ArtStor’s collection consists of images contributed by participating institutions. Even though the number of contributors is significant and will only expand in the future, the collection will remain limited in scope compared to the number of images that can be retrieved from the open World Wide Web.

The Visual Art microformat could be employed by a domain specific search tool to display the results limited to works of art. A search could be performed with a specific search criteria related to any one of the elements proposed with the microformat, e.g. all works by Claude Monet in the Cleveland Museum of Art which are currently on display. The possibilities are numerous.

Easier Exchange of Data

It is certain that images of works of art are not a subject of exchange in the same way contact information like phone numbers or email addresses are. Nevertheless, Miranda Hall-Carrier notes that “the trends of information accessibility, personalization, participation and personal expression, and social networking are not going unnoticed in the museum world” (2008, p. 26). Some institutions have experimented with embedded RFID technology and mobile computing devices to enhance the visitor experience inside the museum, but museum web sites have been slow to change. Saving a web image from any museum’s web site to one’s own computer typically makes the image devoid of any original contextual information including the title itself. The least a microformat could offer is an easy way for web authors to attach the basic metadata to the files themselves. Implementations of metadata embedding can vary significantly, but to take a very simple example, the label information visible on the web site could be embedded into the spotlight comments field of a file downloaded onto a Mac OS system or the XMP-based metadata fields of a file downloaded to Windows system so that users could
search for images on their computers by the title, the artist, or the name of the museum whose web site they downloaded the images from.

Additional valuable context could be provided by museum web sites. For artwork with significant location of origin, such as the “Group of Attendants" from Kota Region, Rajasthan, India (Figure 14), the Geo microformat might be used to embed the latitude and longitude of the location, so that a click on a hyperlink may open Google Earth or another geographic mapping software, letting visitors see how the location relates to either the natural landscape or present-day borders and inhabited places.

Figure 14. Group of Attendants, Kota Region, Rajasthan, India, 12th–13th c. next to its label at the Nelson-Atkins Museum of Art.

Additional Tools

Many art history instructors are uploading slides to their university’s web servers for students to use as study guides. These can be in the form of web pages, Microsoft PowerPoint slideshows, or less elegant Microsoft Word documents with lists of images and captions which needed to be memorized and which students are tested on during the exams. Art history students can be seen before the exams studying from slides printed on paper rather than studying from the web page or a digital file. Printing on paper allows one to make index cards, which can be physically manipulated so as to look at a slide in isolation; hide the caption; shuffle and sort slides chronologically, according to the artist, or according to whatever other mnemonic criteria one can
think of. This is something that a static web site can not do easily. But the malleability of data representation was intended to be a strong point of digital technologies (Negroponte, 1995, p. 71).

How the metadata comprising the Visual Art microformat could be visualized is illustrated by a concept titled Aurora by design consultancy Adaptive Path (2008). Aurora illustrates the potential of both being able to look at a few different representations of the same data and data portability. In the concept video, two agriculturists solve a dispute over the weather data by being able to look at tabular information of rainfall in a graph form and by being able to superimpose one graph representation over another for comparison purposes. This type of manipulation is dependent on the data being described semantically.

A video by Adam Behringer, a software engineer, demonstrates an innovative three-dimensional visual timeline from a software called Timeline 3D made by Bee Docs which allows a viewer to both see the details of an image and quite a bit of the context, i.e. the images that precede and succeed the one being looked at (2008). Timeline 3D is a desktop-based application and it saves data in a proprietary format. It requires images to be imported into the application and cannot work directly with images on the web. This application might be extremely suitable to visual art, since many art history text books employ timelines to present movements and influences. The capabilities of web browsers that currently implement the latest cascading style sheets (CSS) 3 specification such as Apple’s Safari allow for such application to be entirely web-based.

A web-based learning application called Quizlet (http://quizlet.com) demonstrates a few ways in which digital flashcards can help the learning process. Originally developed for learning languages, it lets registered users create sets of flashcards by typing pairs of terms and definitions. Visitors can also use sets already made by others, to familiarize themselves with the foreign terms, take a self-designed test, and learn while playing interactive games with words. Its creator, Andrew Sutherland, implemented an image-based studying feature which is limited to images available on Flickr, a photo sharing web site. Playing games with images of paintings for example seems unsuitable, but visual learning tools could at least be able to generate well laid-out PDF documents which could let students print index cards from web sites with greater efficiency.
All three examples suggest that there is a fertile ground for innovative applications which might be beneficial to both art history students and educators. In order for the tools to be useful in the domain of visual art, the label data which describes works of art images on the web needs to first be accessible in a semantic form.
CHAPTER VI
BEYOND SPECIFICATIONS

Technical specifications address only part of a problem with adoption and use of microformats. A clear and simple specification for a microformat that is relatively easy to implement by web authors is important for the adoption of that microformat by the development community. Adoption and implementation, however, are only half of the equation. The other deals with the design of interfaces which signal to users that embedded data is available on a web page and that compelling and useful tasks can be accomplished with that data without causing confusion and information overload. Even the most thoughtfully structured data is eventually presented to the users. How do they make sense of the content and what visual form should it take?

Current State of Technology

Presently, no commercially available web browsers offer any kind of built-in microformat detection. If a microformat is implemented in a web page, to be able to take advantage of it directly, users have to either install additional plug-ins or other detection tools, or hope that the author is indicating the presence of a microformat and enabling workflows for the completion of tasks related to it. This was also the case with RSS feeds not long ago. Earlier browsers could not detect nor “read” RSS feeds. Users wanting to subscribe to feeds were left with little choice apart from downloading a separate feed reader application. As the RSS technology gained momentum, most popular browsers such as Microsoft’s Internet Explorer, Mozilla’s Firefox, Apple’s Safari, and the Opera browser added feed auto-detection feature to the browsers which now function as feed readers as well. It is entirely possible that with increased adoption, the microformat detection might be built into the next generation of web browsers. Until then, several options exist for microformat users and authors.
Operator Plug-in

Mozilla’s Firefox browser can be enhanced by a plug-in called Operator made by Michael Kaply. Operator is a rather extensive and configurable tool and can detect hCard, hCalendar, Adr, Geo, Tag, and xFolk microformats. For the indication of available microformats, Operator can optionally use Firefox’s location bar, its status bar, or a separate toolbar. Operator’s interface is shown in Figure 15.

Operator’s address bar icon is certainly an effective solution to indicating the presence of microformats. RSS feeds are indicated in this manner in most browsers and thus the icon in this location supports the convention. A separate operator toolbar which is more informative, provides details that are not necessarily helpful. While detection capabilities can be gleaned from the toolbar, inactive options cannot be manipulated. The toolbar appears and disappears rather abruptly when switching between pages that contain microformats and pages that do not, resulting in vertical jumping of the page. Additionally, the language used in labels and controls, including the names of microformats, is technically oriented. Even though it is safe to assume
that a user who intentionally downloads the plug-in is aware of microformats, nomenclature such as “contacts” and “events” rather than “hCard” and “hCalendar” is much clearer and more appealing to users who may not be familiar with all different microformat specifications.

**Oomph Plug-in and Library**

Microsoft’s Internet Explorer can be enhanced by a plug-in called Oomph which is a result of an open-source effort. The Oomph plug-in functions similarly to Operator and discovers hCard, hCalendar, and hMedia microformats. A small green icon appears in the top left corner of the web page, and when clicked opens an overlay on top of the current page which offers actions related to discovered microformats. The expanded Oomph overlay is shown in Figure 16.

![Figure 16. Oomph plug-in for Internet Explorer. Internet Explorer browser is a copyright © of Microsoft.](image)

The Oomph plug-in also contains a small JavaScript library which developers can insert into web pages to implement the same kind of behavior that the plug-in provides.
Microformats Bookmarklet

Other web browsers, many of which do not feature an official plug-in mechanism in the manner of Firefox, are left with more limited detection options. Users can add bookmarklets, small JavaScript programs which pretend to be bookmarks, to their collection of bookmarks. Rather than opening a web location, bookmarklets perform a programmed function when clicked. Jon Hicks, a designer, had proposed an interface for detecting microformats in the Safari browser which was subsequently implemented in a slightly modified form, as a bookmarklet, by a web developer Remy Sharp (Hicks, 2006; Sharp, 2006). Figure 17 shows Sharp's bookmarklet.

Figure 17. Bookmarklet for detecting microformats made by Remy Sharp. Safari browser is a copyright © of Apple, Inc.

This rather elegant bookmarklet which recognizes hCard and hCalendar has a significant drawback. Provided that the user is familiar with bookmarklets and has furthermore installed Sharp's bookmarklet, it requires a user to click before any indication is given whether microformats exist on a particular web page or not. Unlike the Operator plug-in and unlike Hicks' original proposal, the bookmarklet does not offer auto-discovery in a true sense of the word.
Transient User Interface

Whether microformats will ever gain native support in web browsers in the manner of RSS is a difficult question. Internet Explorer 8, which had announced support for microformats, eventually shipped with a limited support for hAtom only. Chris Wilson, a Platform Architect of the Internet Explorer Platform team at Microsoft, explained that additional microformats were not implemented because his team feared that the user experience would be too inconsistent (Keith, 2008, para. 9). Kaply, the author of the Operator plug-in, also confirms the difficulty of designing an effective user interface:

Microformat UI is a very difficult subject. Microformats could be indicated by UI in the page, but people are averse to having the web browser modify web pages. The other problem is that microformats are not very common yet, so if we put UI in the web browser, it needs to be “transient UI” – that is UI that comes and goes without interfering with the user experience, similar to how the feed button works today. We have yet to find a good solution for “transient UI.” (Cabello, 2007, para. 16)

Apple offers an excellent example of transient user interface described by Kaply with data detectors in its Mail application shown in Figure 18. Email text is shown normally but when the mouse pointer is positioned over a date, address, or a phone number, a light dashed outline with a small button fades in around the object in question. A click on the button reveals a contextual menu with options appropriate for the selected object.
Data detectors are not based on microformats and instead rely on text-parsing and pattern matching. It is worth pointing out that none of the labels in any data detector workflow contain any technical jargon. Their interface is effective because unless the user is about to copy an address or a date from the text, the interface is nonexistent. It only becomes visible if the user is about to manipulate the data directly and offers itself as a shortcut to accomplishing common tasks.

The described plug-ins are not as successful as Mail’s data detectors in achieving the transient quality of the user interface, but the more interesting trend initiated by the Oomph plug-in is the inclusion of a JavaScript library which developers can insert into web pages to detect and extract microformats. In this way, the user is not responsible for initiating the discovery of microformats on the page. Instead, the discovery is author-enabled and automatic. Implementing both microformats and their detection mechanisms of course means more additional effort from the web authors. But as the Oomph JavaScript library demonstrates, this effort can be vastly alleviated by general purpose, ready-made libraries which authors can simply insert into their web pages. Until browsers can natively support microformats, JavaScript libraries provide the best compromise between features, configurability, and unobtrusiveness.
Visual Art Visualized

The intention of developing three videos which are a project component of this thesis is to show how the approach of including a ready-made JavaScript library could successfully provide a user interface to the proposed Visual Art microformat. The proposal for the Visual Art microformat discovery and manipulation interfaces is shown in Figures 20, 21, and 22.

Figure 19. Still of the Interface I: The Visual Art microformat on a fictional list page. Thumbnails © Cleveland Museum of Art.

Figure 19 shows the interface implemented on a list page. List pages are typically a result of searching or category browsing actions. List pages can contain a large number of objects and can be paginated. Providing enough of descriptive information while allowing the page to stay image focused can be a challenge on list pages. List pages can also be a user generated collection of objects saved for later reference such as personalized light boxes or favorites. In this sense, the relationships between all the objects or the set as a whole can be more significant than individual objects themselves.

To display an extreme case, no descriptive information is provided next to thumbnail images in Figure 19. When the mouse is positioned on top of an image, an information box will appear after a brief delay. The delay is significant because it allows the user to move the mouse
freely across the page without intrusive flickering of multiple information boxes. The delay serves as a confirmation that the user’s attention at a specific time is devoted to a specific image. Only the creator, title, date, and medium are shown inside the information box along with options to download the entire set or see more details about the related object.

Figure 20 shows a still from a concept video of an interface enabled by the Visual Art microformat on a detail page. Detail pages provide extended information about the artwork. Figures 12, 13, and 14 display sections of detail pages. All available label information is displayed on a detail page making the duplication of label text inside the overlay unnecessary. Since an image of the artwork is the most important part of the microformat, it is important that any actions enabled by the microformat feel as though they are directly affecting the image. Three actions are provided from the flipped view: download image, copy label, and copy link. If the image contains the embedded Geo microformat, the map with indicated location is shown and action to view the location in Google Maps’ terrain view is also offered. The download image action should determine the operating system of the running browser and download the image file with appropriately embedded metadata to the user’s computer. The copy label action should copy the
label related to the current image to the user computer’s memory omitting the institution-specific information such as the accession number, credit line, audio tour number, and institutional location to prepare the label for use in written text. The copy link action should copy a permanent link to the current page in its shortest possible URL form to the user computer’s memory.


Figure 21 shows an alternative layout for actions described in Figure 20. Many museum web sites prefer a neutral appearance of page elements to allow artwork to gain a greater prominence. These web sites may also feature distinct color schemes and layouts which may be in a discord with the interface from Figure 20. If three-dimensional animation is not appropriate, a more subtle, two-dimensional animation with a configurable color scheme can be employed as shown in Figure 21.

In summary, the proposed interface achieves transiency by remaining hidden until images on a page are about to be manipulated. Unobtrusive clues offer shortcuts for rudimentary actions associated with visual art images on the web. Since the proposals are aimed at a general public, no technical jargon is employed.
The evolution of the web, as briefly described in Chapter I, essentially consisted of linking computers to computers first, then documents to documents. The trend towards linking data to data and ideas to ideas inside of these documents is undeniable. As a former Wired Magazine editor Kevin Kelley understands:

> Every artifact or place, will be a specific representation, will have a specific character that can be linked to directly. So we have this database of things. And so there’s actually a fourth thing that we have not [gotten] to, that we won’t see in the next ten years, or 5,000 days, but I think that’s where we’re going to. And as the Internet of things—where I’m linking directly to the particular things of my seat on the [airplane]—that physical thing becomes part of the web. And so we are in the middle of this thing that’s completely linked, down to every object in the little sliver of a connection that it has. (2007)

Kelly is cautious about predictions because he acknowledges that ten years ago, the media had thought that the Internet was going to be “TV but better.” Today, nobody is certain about what the next 5,000 days of the web will look like. The era when intelligent agents routinely schedule appointments between multiple persons on their behalf and suggest meeting places by minimizing the driving distance may be far ahead. Complexities that the semantic web technologies are facing are enormous. As problems are incrementally resolved, it is not only important that the feedback from the visual community is incorporated into the infrastructure of the future semantic web efforts, but perhaps the semantic web initiatives could also benefit from embracing some of the clarity of execution evidenced in domains of visual arts.

The purpose of designing the interfaces shown in Chapter VI and demonstrating their use through concept videos, which are a project component of this thesis, is to bring clarity to communication of unfamiliar ideas on the web. These interfaces are only a small part of what an infrastructure for embedded semantics could offer to anybody dealing with visual art images on the web. This infrastructure is embodied in the Visual Art microformat proposed in Chapter V. However elementary, interfaces that are comfortably understood and usable by uninitiated users are an important part in the adoption of microformats. The ultimate goal of the wider
adoption of microformats is the ideal of the semantic web. Microformats, which can be embedded into standard HTML without requiring authors to re-describe the content or learn new technologies, are perhaps the missing piece in popularization of the semantic web.

It is my conviction that the microformat proposed in this thesis fits comfortably in the realm of existing microformats. I believe that it offers not only an elegant solution to basic problems that motivated me to approach this subject but that it also contributes to the larger semantic web efforts within the field of visual art.


