Introduction

The *catalogue raisonné*, or reasoned catalogue, has long been a standard tool for representing large art collections. A typical *catalogue raisonné* includes images of artworks along with descriptive metadata, commentary, and background information (often a biography of the artist) about the collection. More recently, technological and infrastructural advances (in particular, cheaper secondary memory, increased network bandwidth, computational power, and digitization technology) have enabled development of the digital *catalogue raisonné*. Some of these catalogues have been developed primarily to support the construction of print-based catalogues (Lanzelotte, et al., 1993; Gladney, et al. 1998), while others are intended for online use (for example, The Vincent van Gogh Gallery and Gemini G.E.L.). The *Picasso Project* (Mallen, 2006) has developed a digital *catalogue raisonné* containing 11,000 of Picasso's artworks, along with 7,000 biographical entries. It is the most complete and up-to-date collection of Picasso's prodigious body of work.

Building on the premise that the logical structures of the book do not support scholarly inquiry adequately (McGann, 1997), we are using the Picasso digital catalogue to facilitate scholarly work with art collections. Researchers, students, and teachers in disciplines such as art history, painting, drawing, history of art, and art appreciation deal with art collections. They analyze and critique individual works and compare and contrast these with other works. They identify similarities between pieces of art and trace threads of influence between artworks, artists, styles, materials, themes, and social, geopolitical, or personal events. These scholars interpret artworks, identify missing links, and communicate their findings. In the context of the Picasso collection, we support scholars in expressing and visualizing the complex, multifarious relationships between artworks via a Web-accessible software interface.

Approach

In a series of informal interviews with faculty members from art education, history, Hispanic studies, art history, and with local K-12 art teachers we found a diverse set of needs, interests, and approaches to working with artworks in both education and research settings. One key theme running through each of these areas is the need to discover and present relationships between artworks, although the specific relationships of interest varied by discipline. The art history scholar wishes to investigate relationships between artworks displayed together in an exhibition or to study works composed when an artist was with a particular lover. The historian wishes to view art in the context of significant historical events, for example, artworks created while Europe was anticipating World War I. K-12 teachers are interested in identifying artworks that provide good examples of specific drawing or painting techniques, such as the two-point perspective or the use of complementary color schemes.
In addition to the interviews, we also attended sessions of two college-level art history survey courses. We observed that instructors typically showed one or two examples of artworks from different artists or art movements, discussing each for a few minutes. In subsequent interviews, the instructors explained that lack of time constrains their ability to include additional works. Creating thematic sub-collections based on the relationships discussed in class could alleviate this problem, enabling students to study additional examples of materials covered in the classroom. These observations of classroom interaction and feedback from educators and researchers have informed our enhancements for supporting the representation and visualization of diverse relationships over the Picasso project’s artwork catalogue.

Picasso’s works cover a broad range of themes, topics, and materials, thus presenting a rich substrate of artworks for building a network of semantically diverse, meaningful relationships. In addition to the image collection, the Picasso project includes extensive metadata related to these works, such as its place and date of creation, medium, dimensions, current location, as well as exhibitions and books in which it has appeared. We leverage much of this metadata to express relationships based on ownership, materials, patronage, or chronology.

**Interactive Relationship Visualizer**

The Interactive Relationship Visualizer (IRV), an interactive, Web-based application, enables visualization of relationships that exist between artworks in the archive. The IRV interface displays image sub-collections connected by the relationship of the viewer’s focus. In addition, it presents connections that exist within artworks in the sub-collection as well as those with others in the archive, enabling users to navigate the intricately interconnected hypertextual web defined by these relationships. While browsing, the display changes to reflect the dominant relationship being displayed. In order to express a rich set of relationships, we are augmenting existing metadata to include type (such as still life or portrait), art movement (cubism, fauvism, surrealism), and content (woman, nude, vase, mirror).

The IRV distinguishes two broad categories of relationships, "inferred" and "specified." Inferred relationships are those which can be expressed in terms of the metadata elements provided for each artwork. Some inferred relationships can be expressed in terms of a single metadata value, such as "artworks created with oil on canvas." Others require mapping a range of metadata values onto a higher-level concept and require definitions involving multiple metadata fields. For example, identifying "paintings created in Paris around the time of World War II" is a two-step process. The system must map the timeframe of World War II to a portion of the traditional calendar and locate paintings created during this time. It then selects from this set, those that were created in Paris. Finally, relationships such as "expensive paintings" involve subjective, theory-driven, and potentially variable definitions. A price that would be expensive in one art market might be comparatively inexpensive in another. Inferred relationships provide a powerful mechanism for exploring, discovering, and expressing relationships between artworks that leverages existing metadata.

In contrast to relationships inferred directly from existing metadata, other types of relationships must explicitly be stated. We refer to these as "specified" relationships. For
example, Picasso sketched several rough drafts of large works, interspersed with smaller works. Thus, a chronological view of artwork around the time the Guernica was painted results in a sub-collection that includes these preparatory works as well as other, unrelated works. Hence, this "preparatory work" relationship must be expressed between early sketches of the Guernica and the final masterpiece. Another specified relationship is images based on a shared subject, for example, Picasso’s interpretive series of works of Diego Velázquez’s Las Meninas. Specified relationships afford us the ability to define and represent relationships between artworks that are difficult to derive from the descriptive metadata associated with each work. This category of relationships is critical for the expression of concepts based in established and novel analytical approaches to Picasso's work—allowing relationships based on information beyond that which is encoded in the collection. The drawback is that participation in specified relationships must be manually encoded.

Figure 1 displays the IRV system design. The Web interface employs specific visualizations for displaying different kinds of relationships. For example, the display of Guernica and its preparatory images uses a visualization that illustrates the centrality of Guernica relative to the other images displayed. In contrast, the display of all artworks in the Las Meninas series uses a table-like view, since no image is clearly central to this sub-collection. We employ artwork images from the Picasso project, reinterpret and extend existing metadata to express myriad connections between these artworks, and facilitate visualization of these relationships to support art scholars from various disciplines.

**Future Work**

We continue to add new metadata to enrich the relationships expressed in our archive. While new attributes enable us to express additional relationships, the growing number of relationships gets increasingly difficult to represent visually. We are investigating mechanisms to display secondary visualizations without overwhelming the presentation.
of the primary relationship views. As scholars analyze Picasso’s works and life, the relationships of their interest are likely to increase in complexity as well as variety. It is not possible to express all imaginable relationships among these artworks a priori, nor is it possible to have all the necessary metadata. Enabling scholars to define useful metadata as well as supporting them in forming new relationships will engage them as partners in this project rather than as mere users.

The IRV has potential for exploration of artwork relationships in the classroom as well as for evaluating student performance via homework and papers. For example, students could explore a relationship and write a short paper about the artworks it encompasses. An instructor could create a relationship and ask students to identify the relationship embodied by the included artworks. Educators need assistance in the form of targeted features for successful use of the IRV in the classroom setting. We continue our dialog with instructors to channel the IRV’s expressive power for enriching education.

References


