Primary Paper

L. Crissaff *et al*., "ARIES: Enabling Visual Exploration and Organization of Art Image Collections," in *IEEE Computer Graphics and Applications*, vol. 38, no. 1, pp. 91-108, Jan./Feb. 2018.

Collections of images can be browsed, individual items can be examined in high resolution, shared, and it is possible to view two images side by side. ARIES and IEEE COMPUTER GRAPHICS AND APPLICATIONS REQUIREMENTS Art historians usually work with images of paintings, drawings and sculptures taken not only from their own databases, but from sanctioned databases, as well as the web.

The initial goal was to create an environment to help art historians explore and organize art images in a virtual space. Particularly it should support the ability to: superimpose images, allowing for a quick and easy determination of physical changes to works of art that may have taken place over time due to damage or conservation. In addition, it should have the ability to easily adjust images to appear in the correct size relative to one another, a function necessary for planning the accurate hanging of works of art in a particular exhibition space, recreating historical displays of art, or even producing fantasy exhibitions with works of art that no longer exist or that cannot be moved from their current locations.

Projects carried out by art historians share the common need to view works of art. When these works are unavailable for study, which is usually the case, art historians substitute visual surrogates in the form of photographs or digital images. In some cases, they just want to check whether two images represent the same work of art or, perhaps, similar works by the same artist or by two different artists.

The ARIES interface gives art historians a place to gather these images and to explore them in many ways, according to the needs of a given project.

The following features can be used in the ARIES:

1. The right mouse button, when hovering over a group, enables other operations, such as visualizing every image in the group, throwing all images within the group to the lightbox canvas, removing a group, and annotating a group with metadata.

2. Once an image is selected in the lightbox canvas, image menu or group menu, the elements within the metadata view are available to receive the appropriate data by the user on the top-right corner of the application.

3. The shortcuts enable a user to remove images from all views, enlarge images to fit the entire viewport occluding other images on the lightbox canvas view, and hide/show the three views (image menu, metadata, group menu) to allow for more space to work on the lightbox canvas view.

Unlike physical light boxes, whose main function is to bring together images for comparison by the human eye, ARIES can leverage digital image processing to manipulate images by size, color, and background.

By examining types of images of a work of art, such as x-rays, infra-red reflectograms, prints, drawings and historical photographs, one can make judgments about changes in the artist's intent from drawing to finished work, changes to the work over time, and its representation in other media such as prints.

ARIES provides several filters: grayscale, brightness, contrast, color overlay, and edge detection.17 These filters can be used to emphasize or remove features from images, providing art historians with a better basis for visual comparison.

Since the goal of this work was to design a prototype system to help art historians to visually manipulate and organize art images, the authors focused our efforts on the client development. With Adobe Bridge, probably the best currently available tool for this type of work, the authors were able to move images around, but Adobe snapped the images to a grid, making them hard to work with. This meant that all the images were no longer visible at once on the screen in their new groupings, so that individual folders had to be opened to see them, and the context of the entire oeuvre of the artist was lost.

The authors were able to make close observations and track stylistic changes of the works of art by utilizing the lens tool in ARIES—matching corresponding points and then navigating to different corresponding areas of the images simultaneously.

An important contribution of this work comes from combining and adapting these mechanisms into a novel unified system that fills an important gap created by the wide adoption of digital images in art research. Expert feedback from art historians, a unique benefit of ARIES is that it provides a dedicated out-of-the-box image workspace with an intuitive interface that supports exploration, manipulation, annotation, grouping and sharing of art images in a single environment that can be shared with multiple users.

Secondary Paper

"*Visual comparison for information visualization" by*

Michael Gleicher, Danielle Albers, RickWalker, Ilir Jusufi, Charles D. Hansen, Jonathan C. Roberts

I have chosen this to be the secondary paper because it talks about juxtaposition and superimposition. Juxtaposition and Superimposition is the key feature implemented by ARIES. ARIES implements these strategies to simplify the identification of similarities of different images and interpret complex visual details according a particular task. Images can then be annotated to record new discoveries.

Without the use of juxtaposition and superimposition ARIES cannot perform the desired functions and will not be able to compare the features of the 2 images in order to completely compare the 2 images provided thus failing its basic use and not helping the museum curators or the users at all. The paper talks about developing a general understanding of comparative visualization and facilitating the development of more comparative visualization tools.

Hence without the knowledge of juxtaposition, superposition and explicit encodings ARIES would not be possible which makes this study/paper the most important paper linked to the development of ARIES.

Summary:

While visualization has traditionally focused on tools for examining individual objects, the past few years have seen an increasing number of systems explicitly designed to address comparison tasks. By providing a simple map of the space of designs, the authors model can help in understanding the patterns common in the comparison of complex objects.

A taxonomy is proposed that divides the space of comparative designs into three general categories– juxtaposition (showing different objects separately), superposition (overlaying objects in the same space) and explicit encoding of relationships. The three categories can be distinguished by the principal mechanism used to make connections between objects: juxtaposition uses the viewer's memory, superposition uses the visual system and explicit encodings use computation to determine the relationships.

Although the authors taxonomy might contain seven different categories (juxtaposition, superposition, explicit encodings, juxtaposition + explicit encodings, superposition + explicit encodings, juxtaposition + superposition, and all three combined), the authors consider only three basic categories and three hybrid categories. The hybrid categories are important as they provide designs that mix the basic design elements to address issues in any particular one.

Common interaction paradigms to assist comparison include brushing and linking to make connections between related components, interactive rearrangement and alignment to reorder objects to allow for easier comparison, and view control mechanisms specialized to facilitate comparison.

However, rather than trying to define a clear boundary of what is, and is not, a visual comparison of complex objects, the authors simply have aimed to include enough examples to see the diversity in

comparison designs. This has caused the authors to exclude some systems that compare less complex objects, but also to omit systems that compare complex objects by applying analysis that reduces the complexity of the objects, such as dimensionality reduction, and then uses standard methods for the visualization of collections of simpler objects.

Although the use of analysis to allow standard visualization approaches to be applied for the comparison of complex objects is a common and important approach, the authors have chosen to focus on the use of visual designs that directly compare complex objects.

- Pure juxtaposition designs arguably rely on the natural ability to see pattern in repeated objects, which can be helped through careful design and placing the objects sufficiently close together.
- Superposition is commonly used for situations in which either the spatialization is a key component of the data or the comparison or different objects being compared are similar enough to one another that they can be viewed on the same plane for the purpose of detecting similarity and difference between objects.
- Explicit encoding The explicit encoding category includes designs in which the relationships between objects are shown explicitly by providing a visual encoding of them.

In contrast, hybrid designs use superposition (or juxtaposition) to show the relations between objects as well as having relationships shown explicitly.

The combination of juxtaposition and explicit encoding includes designs that show multiple objects to be compared separately while explicitly showing specific relations that have been computed.

The combination of superposition and explicit encoding of relationships between objects includes designs that show multiple objects within the same coordinate system. Superposition/explicit designs are frequently used in situations where a summarization of an object or group of objects can be represented using a superpositioned visual glyph, such as a star plot.

However, although this broad range of tools has a great diversity in the kinds of data, application domain and designs used to show comparisons, all of these designs are built from the three primary building blocks: juxtaposition, superposition and explicit encodings. By focusing on the common elements of how visual comparison is performed, independent of the data types or domains, the authors emphasize that we can gain insight into comparison in general, as well as find ways to transfer designs between applications.