

ABSTRACT

Title of Dissertation: Understanding and Supporting Visual Communication
within Costume Design Practice

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Theatres provide artistic value to many people and generate revenue for communities, yet little research has been conducted to understand or support theatrical designers. Over 1,800 non-profit theatres and 3,522 theatre companies and dinner theatres operate in the United States. In 2008, 11 million people attended 1,587 Broadway shows for a total gross of 894 million dollars. These numbers do not take into account College and community theatres, operas, and ballets, all of which also require costumes. This dissertation studied image search, selection, and use within costume design practice to: 1) understand how image use as a collaborative visual communication tool affects the search and selection process and 2) assist an often overlooked community.

Previous research in image search and selection has focused on specific resources or institutions. In contrast, this research used case study methodology to understand image search, selection, and use within the broad context of an image-intensive process. The researcher observed costume designers and other theatre members as they located, selected, shared, discussed, and modified images through an iterative design process resulting in a final set of images, the costumes themselves. The researcher also interviewed participants throughout the design process, photographed artifacts, and

conducted a final interview with participants at the end of each case study. The resulting data was coded using grounded theory and guided by previous research.

Based on the analysis, the researcher suggests a three-stage model that describes image use in costume design and provides a starting point for understanding image use in other collaborative design practices. Participants used a wide range of analog and digital resources, including personal and institutional collections, but often used the same three search and selection strategies regardless of the resource type. Set building and refinement, image comparison, and tagging were all important features of the image search and selection process but are not well supported in most image search systems. In addition, participants continuously added resources to personal collections for future use on individual productions.

This research set out to understand search and selection within the context of collaborative use on a single production, but what became apparent was the central nature of collaboration across productions to the search and selection process itself. Personal networks between costume designers and within the theatre community played a central role in solving challenges costume designers encounter as part of their work.

This research bridges a gap in current image research by placing image search and selection within the context of a collaborative design practice. At the same time, it suggests guidelines for developing technology to support a community which has long been overlooked. With additional research, the findings from this research can be extended to apply to the theatrical community as a whole and also to other design professionals.

Understanding and Supporting Visual Communication within Costume Design Practice

by

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Dedication

This dissertation is dedicated to my parents, Linda and James Bradley, whose patience, support, and unwavering belief that anything is possible and all challenges can be overcome has inspired me and many others to pursue their dreams.

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This study would not have been possible without the costume designers, directors, and other theatre members who shared their time, work, art, and insights with me.

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Chapter 1: Introduction

Overview

- Background
 - Study Goals and Expected Contributions
 - Why Costume Design?
 - Methodology
 - Definitions of Key Terms
 - Summary and Chapters Ahead
-

This study investigates how costume designers search for, select, obtain, and use images within the broader context of cognitive and affective visual communication across communities of practice. The resulting system requirements for a costume designer's workbench will assist with the creation of better digital tools for individuals and communities of practice who use images to communicate.

Images play a key role in costume design practice. Images articulate factual information such as time period, culture, and social status as well as affective information such as the production's mood and characters' personalities. Costume images communicate this visual information between the costume designer(s) and members of other communities of practice involved in creating a theatrical production. The varied purpose for which costume designers use images provides an opportunity to study how purpose influences search and selection behavior. Investigating visual information needs independently of available systems and within a visually centered work context may also suggest new approaches to image search for the general public.

1.1 *Background*

Costume design images must both inform and inspire. They convey factual information such as the play's period and culture, the character's social status, and the

garment's construction as well as affective information such as the scene's mood, character's personality, and play's essence (Cunningham, 1984, p. 50). When discussing images produced in costume design within an instructional text, Ingham and Covey (1992) stated, "There are very few rectangles of paper or board anywhere else in the world that must communicate as much information, aesthetic as well as practical, as a costume sketch (p. 88)."

Costume design images act as a focal point for discussion between costume designer(s) and:

1. Director(s),
2. Costume shop staff,
3. Set designer(s),
4. Lighting designer(s), and
5. Actors.

Each of these individuals or groups enter design discussions with distinct viewpoints informed by their professional practice, previous experience, and role within the larger theatrical production community. Images bridge the boundaries between these distinct communities of practice, allowing them to reach consensus about the final image, the costumes themselves. In this role, images function as boundary objects (Star, 1989) and/or boundary negotiating artifacts (Lee, 2007) by providing a means of communication between people with different expertise, skills, roles, and activities. They can thus be used to study these communication processes. This study investigates collaborative image use within design practice.

1.2 Study Goals & Expected Contributions

According to the U.S. Census Bureau, 3,522 theater companies and dinner theaters reported payrolls in the US in 2005 (Table 1191). In 2006, 1,893 nonprofit theatres reported presenting 172,000 performances. In the same year, Broadway alone opened 39 new productions and presented approximately 12,000 performances of old and new productions (Table 1994). While these statistics provide some concept of the number of productions created or recreated each year, they do not include the even larger number of community and college theatres that present theatrical productions. All of these require costumes. Some of these costumes are created from scratch while others are pulled from existing personal or institutional collections. All require some type of design process.

This study's goals are:

1. To understand image use during collaborative costume design;
2. To propose new theory about image use for communication between communities of practice within costume design;
3. To identify the effect(s), if any, of the intended image use on image search and retrieval practices in costume design;
4. To develop user requirements for image search and retrieval systems.

A mapping of these goals with the resulting research questions is provided in Table 1 (p. 12).

It is hoped that the results of this study will inform the creation of better digital tools for other individuals and communities of practice who use images to communicate various types of information. Designers, illustrators, artists and other visually centered

professionals will benefit from improved visual search, retrieval and communication tools. In addition, the constraints of existing systems often restrict studies of new and innovative solutions to image search. Investigating visual information needs independently of available systems and within a visually centered work context may also suggest new directions for image search for the general public.

1.3 Rationale for Costume Designers

Design processes of every type contribute to everyday life, resulting in the physical environment in which people live, the clothes worn, the products purchased, and the software used. Costume designers were selected as the starting point for understanding image search and use within the design process because of several factors which facilitate research:

1. Costume designers work within a clear time frame defined from the initial reading of a play to opening night.
2. They work within clear communities of practice (costume designers, directors, costume shop staff, set designers, lighting designers, and actors) within a larger community of practice (theatre).
3. They use a variety of research sources and types of images within their work.
4. The primary researcher has access to this community through prior work.

These factors make costume designers excellent participants to develop theory and guidelines that can be evaluated with other design professions.

1.4 *Methodology*

1.4.1 Overview

Using in-depth, qualitative methodology, three case studies including a pilot study, were conducted investigating the use of images during the costume design process. Because this study focuses on negotiated meaning and human processes, the naturalistic assumption of multiple realities is used (Guba, 1982, p. 77). Within the naturalistic paradigm, overarching generalizations are not attempted; rather, this study aims to produce a model and user requirements for image search systems that can be investigated further in other domains.

Within the naturalistic paradigm, case study methodology as described by Yin (2003) was used. Yin argues that the case study methodology has a distinct advantage when, “a ‘how’ or ‘why’ question is being asked about a contemporary set of events over which the investigator has little or no control (p. 9).” The research questions discussed in the next section fall into this category.

1.4.2 Research Questions

Qualitative research uses foreshadowing questions which evolve over the course of a study rather than the fixed hypotheses associated with quantitative research. Creswell (2003) points out that, “Qualitative research is exploratory and is useful when the researcher does not know the important variables to examine (p. 22).” This study investigates a broad question:

How can technology support visual communication of cognitive and affective information within design practice?

To do this, the study focuses on the following foreshadowing questions. These are expanded in Chapter 3:

RQ 1: How are costume design images manipulated and/or created?

RQ 2: How are images used to communicate and collaborate across communities of practice within the costume design process?

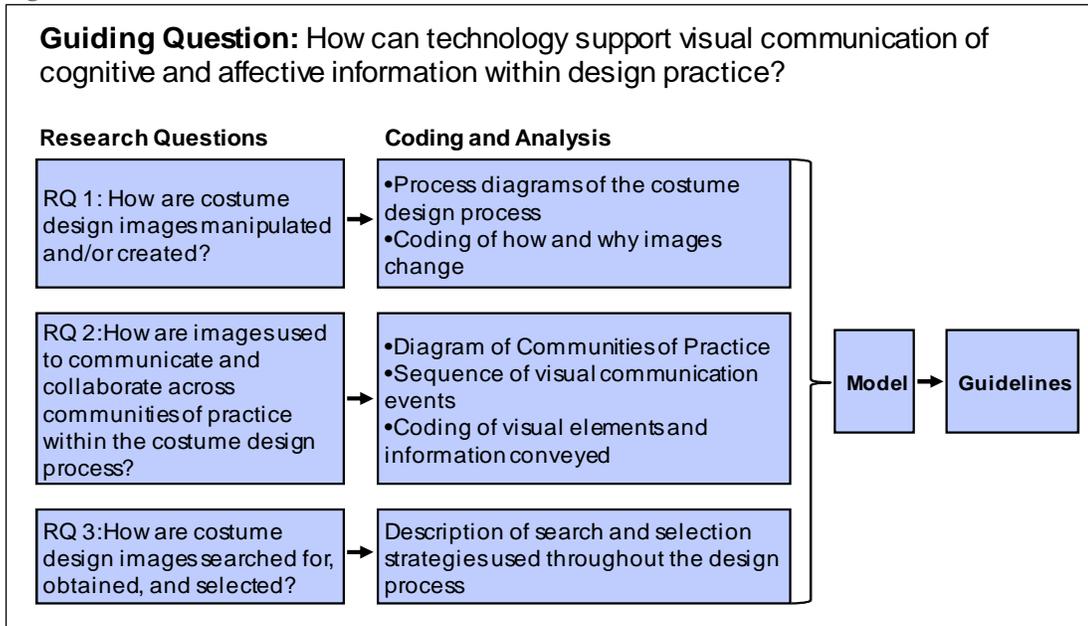
RQ 3: How are costume design images searched for, obtained, and selected?

1.4.3 Research Plan

Because this study centers on the use of images for visual communication, the unit of analysis for the research was the images selected, created, and used. Wenger (1998) presents a theory of reification, defined as, “the process of giving form to our experience by producing objects that congeal this experience into ‘thingness.’ In so doing we create points of focus around which the negotiation of meaning becomes organized (p. 58).” This theory guides the interpretation of images as a tool of meaning-making throughout this study and serves to emphasize the importance of the image over any specific participant. Thus, the researcher followed the image through the design process rather than any human element, such as the costume designer(s).

The three case studies focused on collaborative visual communication during the costume design process. Observations, notes, transcripts, and images from these case studies were coded to develop a model of image search, selection, and use during design. The resulting findings and model were then employed to develop emergent guidelines for software to support costume design practice, referred to herein as “a costume designer’s workbench”. Figure 1 lays out the research plan.

Figure 1: Overview of Research Plan



1.5 Definition of Key Terms

Design Process

Design is a process for creating a plan, often in visual terms, for an object with both functional and aesthetic purposes. Carroll and Rosson (1985) state that design is a nonhierarchical *process* that is neither strictly bottom-up nor top-down. During the design process, partial and interim solutions may evolve which are not used in the final product and new goals are often discovered (p. 5).

Affective vs. Cognitive Communication

Affective communication conveys feelings, emotion, and/or mood while cognitive communication conveys knowledge and facts. This dissertation uses Norman's (2004) distinction; "Both affect and cognition are information-processing systems, but they have different functions. The affective system makes judgments and quickly helps you determine which things in the environment are dangerous or safe, good or bad. The

cognitive system interprets and makes sense of the world. Affect is the general term for the judgmental system...emotion is the conscious experience of affect, complete with attribution of its cause and identification of its object (p. 11).”

Community of Practice

Lave and Wenger (1991) frame communities of practice within a social learning process. Communities of practice are a group of individuals with a shared way of talking about meaning; historical and social resources, frameworks, and perspectives; social configurations; and identity (Wenger, 1998, p. 5). Wenger further refines this by stating that communities of practice define themselves through mutual engagement, joint enterprise, and shared repertoire (p. 73). Individuals belong to multiple communities of practice, formal and informal, named and unnamed.

Legitimate Peripheral Participation

According to Lave (1993) communities of practice pass on their shared behaviors, beliefs, and knowledge through participation within the community. Legitimate peripheral participation is the process whereby newcomers become part of a community of practice through increasing participation.

Image

The definitions of an image from Webster used in this dissertation are a reproduction of a person or thing; a tangible or visible representation; and a mental picture.

Reification

Wenger presents reification generally as, “the process of giving form to our experience by producing objects that congeal this experience into ‘thingness’ (p. 58).”

He includes making, designing, representing, encoding, describing, perceiving, interpreting, using, and reusing within the process.

Boundary Object

The term boundary object originates from work by Leigh Star (Star, 1989) and is further clarified by Etienne Wenger (Wenger, 1998). Boundary objects, “serve to coordinate the perspectives of various constituencies for some purpose (Wenger, 1998, p. 106).” Boundary objects are created by a community of practice to communicate internally and externally. They encode activities, information, and practices of the community. Lee (2007) states that boundary objects pass, “from one community of practice to another with little or no explanation (p. 312-313).”

Boundary Negotiating Artifact

Lee (2007) proposed the term boundary negotiating artifacts for objects that exist within the space between communities of practice, but do not communicate information independent of a negotiating process. “Boundary negotiating artifacts are used to:

- Record, organize, explore and share ideas;
- Introduce concepts and techniques;
- Create alliances;
- Create a venue for the exchange of information;
- Augment brokering activities; and
- Create shared understanding about specific design problems (p. 333).”

Naturalistic Paradigm

Guba and Lincoln (1982) present the naturalistic paradigm in contrast to other research paradigms such as the legal or scientific paradigms. They present five axioms

which contrast naturalistic research with scientific research. Naturalistic inquiry assumes that:

1. Multiple, intangible realities exist as opposed to a single reality;
2. During research, the researcher and participant influence one another rather than the researcher maintaining independent observer status;
3. Research leads to working hypotheses as opposed to generalizations;
4. Actions occur due to multiple, interrelated factors rather than a single cause and effect relationship; and
5. Inquiry is value-bound as opposed to value-free.

Thick Description

Lincoln and Guba (2002) recommend including a thick description with a case study which describes the setting and circumstances of a study. A thick description attempts to incorporate all the variables which may affect the research results and allows future researchers to evaluate the transferability of the results to their particular situation (p. 211-212).

1.6 *Summary and Chapters Ahead*

Visual information retrieval provides a number of challenges for system design. These challenges and possible solutions must be better understood in order to create systems that support design tasks which rely heavily on visual communication. This qualitative study investigates the use of images as boundary objects within costume design practice in order to better understand this community's needs for technological support and contribute to improving visual information system design. Table 1 maps the relationship between the study goals, research questions, and foreshadowing questions

and presents the methods used to address these. The details of this methodology are presented in Chapter 3 Methodology.

Chapter 2 Literature Review presents the background literature for this study. It begins by discussing images, including psychological evaluation of images and theory behind meaning making. It then discusses studies in image search selection and use as well as theory behind these areas. Finally, it discusses theories and studies of design practice as well as text book descriptions of costume design practice.

Chapter 3 Methodology outlines the methodology for the study in detail. It provides a breakdown of the overall research questions into foreshadowing questions and details regarding the study methodology are presented. Finally, it describes the methodology and results from the pilot study including changes made to the overall study approach.

Chapter 4 Empirical Results provides rich descriptions of each case study, including the pilot study, to aid in assessing transferability, and then details the empirical results for each research question.

Chapter 5 Model and User Requirements presents a model of image search, selection and use within costume design practice and then explores emergent guidelines for a Costume Designer's Workbench.

Chapter 6 Discussion, Limitations, and Future Work presents a consolidated discussion of the research findings. It then addresses the limitations of the current study and suggests future work in this area.

Table 1: Relationship Between Study Goals, Research Questions, Methods, and Coding Scheme

Study Goals	Research Questions	Foreshadowing Questions
To understand image use during collaborative costume design	RQ 1: How are costume design images manipulated and/or created?	<ul style="list-style-type: none">• At what point(s) in the design process are images manipulated and/or created?• At what point(s) are images disposed of?• With what intention are images created?• What visual elements are retained through changes?• What visual elements are included with the intention of conveying certain information?
To propose new theory about image use for communication between communities of practice within costume design	RQ 2: How are images used to communicate and collaborate across communities of practice within the costume design process?	<ul style="list-style-type: none">• What are the communities of practice within the environment?• Who uses images to communicate?• What information are images intended to convey?• How do visual elements and verbal or textual descriptions correspond?
To identify the effect(s), if any, of the intended image use on image search and retrieval practices in costume design	RQ 3: How are costume design images searched for, obtained, and selected?	<ul style="list-style-type: none">• What resources do costume designers use?• How do costume designers select and organize images?• How do search and selection strategies change as the costume design process evolves?• What, if any, are the variations in the search and selection process based on the intended image use?
To develop user requirements for image search and retrieval systems	How can technology support visual communication of cognitive and affective information within costume design practice?	

Methods

- Multiple case studies
- Interviews, tape recorded and transcribed when possible
- Observation during search, selection, and use
- Photographs of resulting artifacts
- Coding guided by related literature and grounded theory
- Member checks of resulting model and guidelines

Chapter 2: Literature Review

Overview

- Understanding Images
 - Image Search, Selection, and Use
 - Negotiation within Design Process
 - Summary and Conclusions
-

This literature review provides background information to help the reader understand how the current study fits into existing research and to understand the complexity behind visual search, selection, and use in visual communication. It also provides background research into design practice, focusing on costume design practice.

2.1 *Understanding Images*

2.1.1 Images Defined

As presented in the Chapter 1, this study uses the following definitions of an image from Webster:

1. A reproduction of a person or thing,
2. A tangible or visible representation, and
3. A mental picture.

Images are not limited to a specific medium nor must they be represented in a physical medium to exist. When discussing computer systems, the distinction is often made between images and text. There are psychological and practical reasons for this. Images and text are processed differently in the brain (see Section 2.1.2) and computers have evolved to handle most text in a more efficient manner than other visual representations.

This distinction is less clear when looking at visual resources. McCloud (1993) proposes a model which places text as the most iconic and subjective means of visually

representing information. McCloud's model also captures the complexity of discussing images which can include ranges from simple, objective visual elements such as a circle or color to complex and specific photographs.

Video and diagrams also complicate the distinction between images and text as they include both. Because the goal of this dissertation focuses on system design, it maintains a distinction between images and text while recognizing this distinction is somewhat arbitrary. The term "image" is used for any representation that includes non-textual elements regardless of whether text is included as well.

2.1.2 Image Interpretation

Jorgensen (2003, p. 7-68) provides an overview of what is known and theorized about how the human brain processes images. The difference between visual and textual processing is most relevant to this dissertation. Research has identified two distinct modes of thought, one verbal and one nonverbal that occur in the brain. Edwards (1999) summarizes the findings

...the mode of the left hemisphere is verbal and analytic, while that of the right is nonverbal and global. New evidence found by Jerre Levy in her doctoral studies showed that the mode of processing used by the right brain is rapid, complex, whole-pattern, special and perceptual—processing that is not only different from, but comparable in complexity to, the left brain's verbal, analytic mode (p.33).

The left and right hemisphere distinction is somewhat simplistic; however, the fact that the brain handles verbal and non-verbal processes separately is fundamental to understanding the complexity in identifying visual content.

Scientists believe that visual information is processed along two pathways in the brain, one which specializes in spatial information and coordinating vision with action, and a second which identifies objects (Anderson, 2005, p. 41). The first pathway ties

directly into the emotional center of the brain which controls the flight or fight response. This pathway is much faster than the second, such that all visual information is filtered through an affective response before being evaluated cognitively (Barry, 2005, p. 45-62). The brain attempts to match what has been seen with previous templates, patterns, or features in order to identify what was viewed and assign an appropriate response (Anderson, 2005, p. 48-58). Because of this, human visual perception does not duplicate reality.

...what our eyes register is not a picture of reality as it is. Rather our brains combine information from our eyes with data from our other sense, synthesize it, and draw on our past experience to give us a workable image of our world. This image orients us, allows us to comprehend our situation, and helps us to recognize significant factors within it...The visual world, then, is an interpretation of reality but not reality itself. It is an image created in the brain, formed by an integration of immediate multi-sensory information, prior experience, and cultural learning (Barry, 1997, p. 15).

Because the human brain processes visual information based on a variety of unique factors, meaning often varies among individuals and even over time for the same individual.

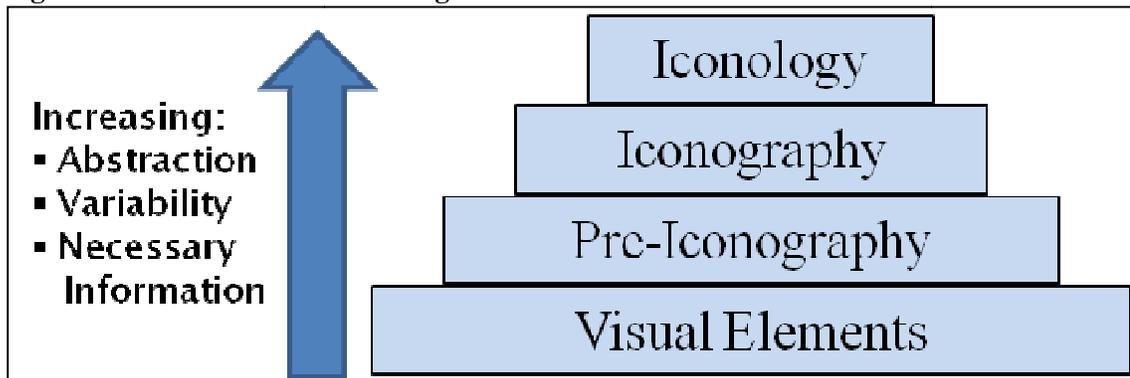
An example of how image meaning changes based on context can be found in Drummond (2006). This article traces changes in the meaning of Caravaggio's images as they move through time from the time when Caravaggio creates the paintings to the time of commercialization and sale of the images on consumer goods in modern times.

Theories about meaning in and interpretation of artistic representations (Panofsky, 1939; Barthes, 1977; Shatford, 1986; Risatti's, 1987; Layne, 1994) present multiple levels of content. The authors use different terminology and slightly different hierarchies that have been simplified into the following four levels:

1. Visual elements (Line, color, texture, shape, style, perspective and spatial relationships)
2. Pre-Iconography (Common Nouns)
3. Iconography (Proper nouns)
4. Iconology (Emotional content and meaning)

Each level builds upon the previous one and becomes increasingly abstract, variable, and reliant on external information (See Figure 2). A detailed discussion of how these theories relate to the model below follows.

Figure 2: Levels of Content in Images



Visual elements are image attributes such as lines, color, texture, shape, style, perspective, and spatial relationships. Visual elements provide the most basic and concrete level of meaning. In an article on art criticism, Risatti (1987) refers to visual elements in two of four levels of analysis. The most basic level of analysis, Descriptive Analysis, requires the recognition and description of visual elements in a work of art (p. 221). Formal Analysis, the second level, involves recognizing visual relationships between visual elements as well as the coherent structure held together and ordered by the use of similar shapes, forms, and colors (p. 221).

The actual objects represented in the image make up the pre-iconographical and iconographical content. These levels of content correspond with Internal Analysis, Risatti's (1987) third level of analysis, which focuses on an artwork's inherent aspects (p. 222).

Pre-iconographical content can be identified using nouns to generically describe the people, objects, animals, events, actions, places, and time depicted in an image. For example, an image analyzed for pre-iconographical content depicts several men with a flag in a boat crossing a river during winter. Pre-iconography requires only practical experience to interpret and most individuals, regardless of individual variances such as culture, age, or education, will arrive at similar interpretations. This level has been described as “generic of” (Shatford, 1986; Layne, 1994) and the “informational” meaning (Barthes, 1977). Panofsky (1939) includes “expressional meaning” at this level, but indicates this is an obvious affective meaning that most individuals can interpret based only on empathy with the image. In general, affective response to an image falls within the iconological level of interpretation.

Iconographic content refers to specific or conventional information contained in an image. Typically described using proper nouns, this content requires additional familiarity with a specific culture for accurate interpretation. The example above, when analyzed for iconographic content, depicts General George Washington and his men crossing the Delaware River on December 25, 1776 during the American Revolutionary War. Individuals with incomplete or varying understanding of the culture may identify different instances or fail to realize any iconographical meaning at all. Panofsky (1939) refers to this level of interpretation, which requires familiarity with culturally specific

themes, stories, and allegories as iconographical analysis. Barthes (1977) refers to this as the symbolic meaning and suggests semiotics as the primary means of interpretation.

Iconological content refers to the meaning of the image. In order to interpret visual meaning at this level, the viewer must synthesize pre-iconographic and iconographic content as well as information about the creator and circumstances of creation or viewing. Thus, successful identification of iconological content may require knowledge of the image's history, format, location, and relationship to other images and text as well as information about the image's subject. Risatti (1987) refers to this as 'External Analysis'.

The most complicated level of analysis in his framework, external analysis requires understanding the image within a larger historical, ideological, political, or psychological context (p. 222). Barthes (1977) refers to this as the obtuse meaning which contains an emotional value that can only be incompletely expressed in the language system. This level of meaning is the most affect oriented and ties in to the part of the brain which evaluates images for an affective response rather than a cognitive interpretation. Because of the knowledge required and the affective component, iconological interpretation varies based on the individual viewer or the circumstances under which the same viewer sees the image.

To summarize, the human brain processes visual information in a manner that is distinct from the way it handles textual and verbal information. Because of this, visual information contains the potential for a large number of interpretations. Within design areas, images can be deliberately encoded or interpreted with multiple, increasingly

complex and abstract levels of meaning. Individual interpretation may vary, and this may affect how images are created, searched for, selected and used for communication.

2.2 Image Search, Selection, and Use

This section focuses on findings from search, selection and use studies centered on the user. Because of this dissertation's focus on designing a new system to support costume design practice, studies on indexing and cataloging and existing systems have not been comprehensively presented. A detailed discussion of formal image indexing and organization can be found in Jorgensen (2003, p. 69-138).

2.2.1 Methodologies

The studies in image search, selection and use have used a variety of data sources:

1. Email requests to a reference service (Armitage, and Enser, 1997; Collins, 1998; Cunningham, Bainbridge, and Masoodian, 2004; Fidel, 1997; Goodrum, 2005; Jorgensen and Jorgensen, 2005);
2. Query logs from image search engines (Goodrum and Spink, 2001);
3. Self administered questionnaires describing searches (Chen, 2001; Cunningham and Masoodian, 2006); and
4. Case studies involving questionnaires, interviews and/or observations (Keister, 1994; Markkula and Sormunen, 2000; Choi and Rasmussen, 2002; Hertzum, 2003; Westman and Oittinen, 2006.)

Each of these kinds of data has advantages and drawbacks.

Analyzing email requests to a reference service allows for content analysis of requests created independently from a retrieval system. Because the information is digital, analysis can be automated once initial coding has been conducted. This allows

for larger sample sizes. Occasionally, these email requests provide contextual information which can add to the analysis, but overall information about the context of the information needed and the use of the images after retrieval remains limited.

Query logs from image search engines provide even more limited information. The structure of the requests also depends heavily on the interface design. This methodology allows researchers to study large samples, but the findings apply only to the search task and contain no contextual information. The primary study conducted using this methodology selected the data set from search engine queries by using only queries including pre-identified image terms. This technique biases the dataset since it excludes searches conducted by topic where results are filtered or browsed for images.

Self-administered questionnaires describing searches provide more information than the previous two methodologies. They include information about the motivation and context for the information need and can ask about search success and use; however, testing risks exist since the data relies on self reporting and these reports are the only data source.

User studies involving questionnaires, interviews and/or observations provide rich data on the entire search process. Since data sources are typically triangulated through various collection methods, the validity of the results also improves. The disadvantages to this methodology stem from its time requirement and work-intensive nature. User studies of this nature can realistically be applied only to small samples and typically these focus on a single defined group of searchers. Consequently, the findings may be transferable but are not generalizable. Because of this study's focus on a larger practice independent of an existing software system, the case study methodology is used, and

suggestions for further research to test the theories developed are presented in the final chapter.

2.2.2 Search and Selection Strategies

Various studies revealed that searchers had difficulty articulating their visual information needs. Westman and Oittinen (2006) studied journalists and archivists at a newspaper to understand search and selection within a journalistic work context. They used observations and interviews, and analyzed queries and image requests. They found that, “image needs were often fuzzy and could not be fully explicated. Most often it was, however, possible to name a critical object that should appear in the image. The search was then based on querying for this object (p. 105).” Markkula and Sormunen (2000) studied journalists’ use of a digital newspaper photo archive to locating images to illustrate articles. They found that, “the selection of search keys for general search topics was considered difficult. Journalists presumed that the archive contained photos relating to topics of interest, but they just had not discovered the right way to retrieve them (p. 275).” The request process reflects this confusion. Keister’s (1994) review of reference requests for the Prints and Photographs Collection at the National Library of Medicine found that, “patrons do not ask for pictures in a consistent, traditional manner (p. 9). Markkula and Sormunen (2000) found that searchers relied on trial and error rather than carefully constructed queries (p. 275). Goodrum (2005), who analyzed 7,527 digital reference requests from AskERIC and VRD, points out, “The difficulty users often have in translating their image needs into verbal or written expressions is exemplified by the patron who states, ‘I can’t tell you what I want, but I’ll know it when I see it!’ (p. 46).”

The separate mental processes used for visual and textual information may make it difficult to articulate a visual information need in a textual query.

Two strategies seem to emerge to solve the difficulty in articulating visual needs in textual terms: query reformulation and browsing. A study of 33,149 queries on the **Excite** search engine from 9,855 users found that 40% of queries were first time queries and 60% were modified queries (Goodrum and Spink, 2001, p. 303). This study focused on the general public, but an additional study of image search professionals found similar results. From 420 image search sessions submitted to a commercial image provider, 48% of queries were modified by adding one or more terms (14%), eliminating one or more terms (6%), or changing one or more terms (28%) (Jorgensen and Jorgensen, 2005, p. 1354-1355). Additional studies are needed to confirm this trend, but it seems that searchers modify approximately 50% of initial image queries.

Browsing provides a key strategy used during image search and selection. Cunningham and Masoodian (2006) analyzed 64 self-reported image information needs and search strategies by 31 university students and found that browsing, rather than searching, was the primary strategy used to satisfy 20% of the information needs (p. 199). In their user studies of journalists, Markkula and Sormunen (2000) found that, "General search topics easily led to multiple queries and heavy browsing. Specific needs led more likely to just one or two queries and browsing sessions (p. 274)." Westman and Oittinen (2006) found that browsing was the main search strategy for journalists after the initial query and especially important in abstract image needs and collaborative retrieval (p. 105). Jorgensen and Jorgensen's (2005) study of image professionals' use of a

commercial image provider found that browsing took place in 86% of sessions and that an average of 111 thumbnails were browsed per session (p. 1354).

Westman and Oittinen's (2006) user study of journalism-related image queries noted that participants browsed large data sets and attempted to establish a comprehensive set of images with which to work. They found that, "requests for all existing material on a certain topic accounted for nearly a tenth of all image requests (p. 109)." Hertzum (2003), who studied patrons requests to a film archive, also commented on requests for, "everything there is to be found," in the requests to a video archive, but did not note how often this occurred (p.175).

One other search strategy, query by example, occurred in 10% of 404 queries submitted to Google Answers' Visual Arts (Cunningham, Bainbridge and Masoodian, 2004, p. 48). This was not noted in any other study.

During selection, several user studies found that text was critical to evaluating images. In journalism studies, Westman and Oittinen (2006) found that, "Searchers tended to alternate between viewing the textual description and the actual image during the selection process (p. 106)" and Markkula and Sormunen (2000) found that, "The associated caption text seemed to be an important source of information in judging the topical relevance (p. 277)." In a study of 38 faculty and graduate students of American History, Choi and Rasmussen (2002) found that most users did not feel comfortable making a relevance judgment based on image alone and, that in order to make a final judgment, users employed both images and text (p. 705).

Jorgensen (2003) summarizes her review of user studies in image search stating, "These studies indicate that, just as in text searching, there are different types and levels

of queries, users, and searching behaviors in visual retrieval that need to be accommodated (p. 134).”

2.2.3 Queries

Many of the studies analyzed queries based on the levels of meaning discussed in Section 2.1.2 , although each study used varying terminology. These results, consolidated using a single vocabulary, are presented below.

Five main studies reported on the use of visual elements during search (see Table 2 for a summary). Fidel (1997) studied 100 requests, coming in via phone, fax, mail, and email, to a picture archive and found that none specified visual elements. Chen (2001) used self-administered questionnaires to learn about image queries by 29 college art history majors locating images for a term paper. This study found that 1.6% of requests referred to visual elements (p. 266). A study of 187 queries from an image archive and a study of 404 queries from **Google Answers** found visual terms in 7% and 11% of queries respectively (Collins, 1998, p.51-52; Cunningham, Bainbridge, and Masoodian, 2004, p. 48). A user study of journalism related requests found visual elements, specifically the word “colour” mentioned in “a third” of the requests; however the authors point out that this reflects, “the fact that old archives also include black and white photos, which are seldom wanted nowadays (Markkula and Sormunen, 2000, p. 276).” According to these results the searchers studied do not often use visual elements. The result of Markkula and Sormunen’s study may indicate that use of visual elements may vary based on collection or context. These low frequencies may be due to a lack of search systems which support visual queries. Expressing a color or texture in text is inexact and even then it is not searchable in most systems.

Table 2: Percent of Queries/Requests Using Visual Elements

Source	Study Description	Visual Elements
Fidel (1997)	100 requests to a picture archive	0%
Chen(2001)	29 college art history students searching for images for a paper	1.6%
Collins (1998)	187 queries from 2 image archives	7%
Cunningham, Bainbridge, and Masoodian (2004)	404 queries to Google Answers' Visual Arts	11%

The majority of searches include pre-iconographic and iconographic terms, the combination of which is sometimes referred to as *topicality*. These categories represent the contents of the image either generically, such as “a woman” or specifically, such as “Barbara Bush.”

In a study of 1,749 queries from 7 different image archives, Armitage and Enser (1997) found that depending on the collection, between 55% and 86% of queries used pre-iconographic or iconographic terms (p. 289). This range has been verified through additional studies. A study of one month of search logs from a commercial image provider found 58% of requests used pre-iconographic and iconographic terms (Jorgensen and Jorgensen, 2005, p. 1352). Cunningham and Masoodian’s (2006) analysis of self reported search strategies by university students found that 82.5% of requests incorporated topicality (p. 198). A study of 187 queries from two image archives found that topicality accounted for 86% of requests (Collins, 1998, p. 48). While the combination of pre-iconographic and iconographic terms consistently accounts for over half to three-quarters of all search requests, the breakdown between the two levels varies considerably by collection.

Armitage and Enser (1997) refer to pre-iconographic terms as non-unique and iconographic terms as unique. Other studies have adopted this coding scheme along with

the concept of refinement, in which a search term is refined using a second term. Instead of two categories, unique and non-unique, four categories are used: “unique without refinement”, “non-unique without refinement”, “unique with refinement” and “non-unique with refinement”. Chen (2001) analyzed various coding strategies for image queries and found that intercoder reliability decreased when coders attempted to identify categories with refiners (p. 265). Because using refiners decreases validity and because not all studies used all four categories, the results presented in this literature review combine results for “unique without refinement” with “unique with refinement” and “non-unique without refinement” with “non-unique with refiners”.

Table 3: Percent of Queries/Requests Using Pre-Iconographic and Iconographic Terms

Source	Method	Pre-Iconographic	Iconographic	Topicality
Armitage and Enser, 1997, p. 289	186 queries from a general art history image archive	48%	31%	79%
	232 queries from a medical art history image archive	52%	34%	86%
	170 queries from a local history image archive	26%	50%	76%
	294 queries from a local history image archive	11%	44%	55%
	301 queries from a natural history film archive	56%	1.7%	57.7%
	365 queries from a national film archive	32%	25%	57%
	201 queries from an aerial photograph collection	0%	86%	86%
Collins, 1998, p. 48	187 queries from 2 image archives	49%	36%	85%
Markkula and Sormunen, 2000, p. 276	108 journalism related request	24%	62%	86%
Chen, 2001, p. 265	29 college art history students searching for images for a paper	24%	45%	69%

Armitage and Enser (1997) found that, based on collection, pre-iconographic terms accounted for between 0 and 56% of requests and iconographic terms accounted for between 1.7 and 86% of requests (p. 289). As Table 3 illustrates, additional studies have found similar variability. Armitage and Enser explain the variation as follows:

The subject domain of natural history provides little in the form of unique subjects, since flora and fauna are regarded as groups of homogeneous items...In contrast, the [National Monuments Record] sample is dominated by unique over non-unique subject searching. This is attributable to the custom and practice in the library, which insists on users defining a geographical region within which searches are to be made (p. 290).

This example demonstrates how both the collection and the interface and search practices of the library affect search queries.

Armitage and Enser (1997) present the only study that specifically examines the use of iconological terms. Out of 1,749 requests from 7 different image archives, only 2.1% of requests referred to iconological meaning. Other studies examined abstract concepts and/or emotional response, which closely align with iconological content. The findings, summarized in Table 4, indicate that iconological terms are not extensively used during search, at least within current search interfaces.

As discussed in Section 2.2.2, iconological meaning can be phrased in terms of an individual's response to an image. Three studies have found search terms denoting emotional response. Studies of 404 queries to **Google Answers' Visual Arts** and 1,852 journalism related queries found 1% and 4% respectively of searches used emotional response terms (Cunningham, Bainbridge, and Masoodian, 2004, p. 48; Westman and Oittinen, 2006, p. 106). A study of 64 university students using self reported questionnaires found that 13% mentioned emotional response. In a study of 29 college art history students searching for images for their papers, Chen (2001) specifically coded

for emotional response, but found 0% of queries mentioned it (p. 266). While these findings indicate a low use of iconological terms, like visual elements, this may be due to current indexing practices and search system design rather than individual user preference.

Table 4: Percent of Queries/Requests Using Abstract Concepts, Emotional Response, or Iconology

Source	Method	Abstract Concepts	Emotional Response	Iconology
Armitage and Enser (1997), p. 289	1,749 requests from 7 image archives	---	NA	2%
Collins (1998), p. 50	187 queries from 2 image archives	---	0.3%	---
Chen (2001), p.266	29 college art history students searching for images for a paper	---	0%	---
Cunningham, Bainbridge, and Masoodian (2004), p.48	404 queries to Google Answers' Visual Arts	6%	1%	---
Cunningham and Masoodian (2006), p.198	64 University Students	5%	13%	---
Westman and Oittinen (2006), p.107	1852 journalism related queries	5%	0.4%	---

While iconological terms account for few terms used in requests, they become increasingly important during selection, which may indicate that current interfaces do not facilitate iconological queries. In their study of journalism-related requests, Markkula and Sormunen (2000) found that selection was based first on topicality, next on the technical and biographical criteria, and finally on the conveyed impression. Users found the impression difficult to convey in words (p. 277). In a separate user study of journalism related image queries, “Topicality was a necessary but insufficient criterion for relevance...Final selection criteria could also be preferential or reactive; selections were based on personal impressions of images being ‘more interesting’, ‘funny’, ‘different’, ‘most dramatic’ (Westman and Oittinen, 2006, p. 107).”

A study of image tagging by 14 randomly chosen users in **Flickr** found that geographic names were the most commonly used tags (28.21%) while terms relating to humor, poetry, numbers, and emotions were used less than 1% of the time. As with queries, use of iconographic terms for tagging far outweighed use of iconological terminology (Beaudoin, 2007).

2.3 Visual Communication within Design Practice

Costume designers use images to communicate with directors, other designers, costume shop staff, and actors. Each of these groups represents a different community of practice with its own shared way of talking about meaning; historical and social resources, frameworks, and perspectives; social configurations; and identity (Wenger, 1998, p. 5). This section presents literature on communities of practice, boundary objects, and design processes in order to set the stage for understanding image use to communicate across these communities of practice and how that communication affects image creation and modification.

2.3.1 Communities of Practice

Lave and Wenger (1991) frame communities of practice within a social learning process. They define communities of practice as a group of individuals with a shared way of talking about meaning; historical and social resources, frameworks, and perspectives; social configurations; and identity (Wenger, 1998, p. 5). Wenger provides three dimensions that characterize a community of practice (Wenger, 1998, 73-85).

- First, mutual engagement provides coherence through participating in shared activities, maintaining the community through sustained engagement, negotiating shared meaning, and navigating social complexity.

- Second, joint enterprise results from the collective process of mutual engagement and is defined by the participants during that process. Joint enterprise reflects the communal processes and creates mutual accountability.
- Third, the shared repertoire is a collection of resources for negotiating meaning. These include shared routines, words, tools, methods, gestures, and objects.

To summarize, members within a community of practice spend time together, understand the world in similar ways, create similar ways of doing things, and share resources. This study examines costume images as shared resources within and across communities of practice.

Communities of practice can be formal or informal. An individual may be a member of multiple communities at the same time. Costume designers belong to and interact with a number of communities of practice. They represent the larger community of practice of costume designers as a whole who have a shared education in theatre, arts, and/or textiles and a shared set of methodology. Costume designers interact with set designers, lighting designers, directors, costume shop staff and actors who also represent larger communities of practice. Within a single play each of these roles may be represented only by a single individual, but that individual still brings the education and experience from his/her particular community of practice to bear on that production. In addition, the costume designer and costume shop staff potentially form a community of practice for an individual production distinct from that formed by the set designer and set staff. If parts of a theatre staff are permanent and part are hired only for the production, then the new potential members of each community will go through a process of peripheral participation before becoming a full member of the immediate production

community. Identifying the communities of practice in each case study will be important to understanding image use within that case study.

2.3.2 Boundary Objects and Boundary Negotiating Artifacts

Images located and generated during the costume design process form part of the shared repertoire of the theatre community. These images convey cognitive and affective information among various members of the production staff. The creation of this type of communication tool is called reification. Wenger (1998) includes describing, designing, encoding, interpreting, making, perceiving, representing, reusing, and using within the reification process (p. 58). The various ways that costume designers reify their ideas visually forms part of this study.

Boundary objects, “serve to coordinate the perspectives of various constituencies for some purpose (Wenger, 1998, p. 106)” by providing a physical representation of information needed to complete a task. “Boundary objects, as a term, connote a static, archival artifact. However, boundary objects are created within an information flow. Each boundary object is a unique object, but it is also a unique event within an information process (Lutters and Ackerman, 2007, p. 365).”

In a study of a software design team and a product design team, Poltrock et al (2003) found that, “both teams sought information about design requirements or constraints, and a common strategy was to solicit feedback to a design or design concept (p. 246).” One or several designers would create a design and then use it to communicate their information need to the rest of the team. From this viewpoint, images created at each point in the design process present a snapshot of the information and communication process at that moment.

Researchers focusing on boundary objects debate the relationship between standardization and boundary objects. Some research has focused on boundary objects as a form of standardization while other research has focused on boundary objects as a tool in negotiation (Lutters and Ackerman, 2007, p. 344-345). While most research to date has used the term “boundary object” to denote any object existing between communities of practice, this research distinguishes between “boundary objects” and “boundary negotiating artifacts” as suggested by Lee (2007). Based on research into museum design practices, Lee found that within the less standardized, more chaotic practice of design, certain objects were used to supplement communication, change boundaries, and possibly merge communities of practice rather than independently communicate across boundaries. “Boundary negotiating artifacts are used to: record, organize, explore and share ideas; introduce concepts and techniques; create alliances; create a venue for the exchange of information; augment brokering activities; and create shared understanding about specific design problems (p. 333).” This study will explore the distinction between images used as boundary objects and images used as boundary negotiating artifacts in order to better understand how images relate to the negotiation process.

2.4 The Costume Design Process

Design is a process for creating a plan, often in visual terms, for an object with both functional and aesthetic purposes. Carroll and Rosson (1985) state that design is a nonhierarchical process that is neither strictly bottom-up nor top-down. During the design process, partial and interim solutions may evolve which are not used in the final product and new goals are often realized (p. 5). In a summary that reviews theory and studies of design processes across disciplines, Lawson (2005) states:

...it is reasonable to argue that for design to take place a number of things must happen. Usually there must be a brief assembled, the designer must study and understand the requirements, produce one or more solutions, test them against some explicit or implicit criteria, and communicate the design to clients and constructors. The idea, however, that these activities occur in that order, or even that they are identifiable separate events seems very questionable. It seems more likely that design is a process in which problem and solution emerge together (p. 48)

This study places image use within the context of design stages; however, no assumption that the stages proceed in an orderly fashion is made.

Three instructional texts on costume design contributed to an understanding of the costume design process (Cunningham, 1984; Ingham and Covey, 1992; Cole and Burke, 2005). The researcher used previous experience to select texts from the collection of a university that teaches costume design. When asked about instructional texts used, one of the designers in the study referenced Cunningham, but no additional text were suggested. While the authors subdivide the costume design process slightly differently, the process readily divides into recognizable stages (see Appendix 4 for the stages described by each text):

- 1) Understand the play: The costume designers read the play and meet with the director and often other designers.
- 2) Research the play: The costume designers research the clothing practices and tone of the production and setting.
- 3) Create preliminary designs: The costume designers create initial images which may include thumbnail sketches, preliminary sketches, color layouts, and/or fabric swatches and collaborate with the director and other designers.

- 4) Create final designs: The costume designers create final renderings of the costumes.
- 5) Produce the costumes: The costume designers and costume shop staff rent or pull costumes from existing collections as well as select fabrics and patterns to create original costumes.

These stages were used as an initial starting point for data analysis.

Costume texts highlight the extreme diversity of resources used by costume designers, most of which are images. Cave paintings, vase paintings, statuary, tomb artifacts, tapestries, religious paintings, laws, extant clothing, inventories, photographs, newspaper clippings, video tapes, and real-life observation are among the resources suggested. Ingham and Covey (2005) state, “Don’t be surprised if you find yourself looking through pictures of flowers, fish, animals, or insects, or examining fantasy or primitive art. Costume research can take you almost anywhere (49).” This rich variety of potential resources was one of the primary reasons costume designers were selected.

2.4.1 User Studies in Design Practice

Lee’s (2007) work on museum design focused on artifacts which could be textual or visual. She found five categories based on use:

Self-explanation: artifacts created and used privately for learning, recording, organizing, remembering and reflecting (p. 319);

Inclusion: artifacts used to propose new concepts and forms across communities of practice (p.321);

Compilation: artifacts used to bring communities of practice together and coordinate media and designers (p. 323);

Structuring: artifacts used to establish ordering principles, establish tenor in narrative form, and direct and coordinate activities (p. 325);

Borrowed: artifacts taken from the creating community of practice and used in unexpected ways by another community of practice (p. 331).

She found that artifacts would often move between categories.

Vyas et. al (2009) studied the role of artifacts in cooperative design work. They found that, “design representations such as sketches, storyboards, mood-boards, physical models and so on, help in communicating the experiential information within design teams (p. 107).” Work by Belloti and Bly (1996) found that mobility was key to design practice within a product design team. These studies focused on groups of designers collaborating to create a product, while the current study focuses on several types of designers working together to create unique but integrated results.

2.5 Summary: Background Literature

Images can be interpreted in various ways and at various levels presenting unique challenges for image search and visual communication. While some studies have looked specifically at image search and selection and others at artifact use in design process, there has not been a study of image search, selection and use within the context of visual communication in design.

Chapter 3 presents an overview of the research methodology that was used to investigate how technology can support visual communication of cognitive and affective information within design practice.

Chapter 3: Methodology

Overview

- Research Plan
 - Costume Design Case Studies
 - Pilot Study
 - Summary and Conclusions
-

This chapter expands upon the research plan introduced in Chapter 1. It provides a breakdown of the research questions into foreshadowing questions and describes details of the study methodology. Finally, this chapter discusses the pilot study along with resulting changes to the primary study.

3.1 *Overview*

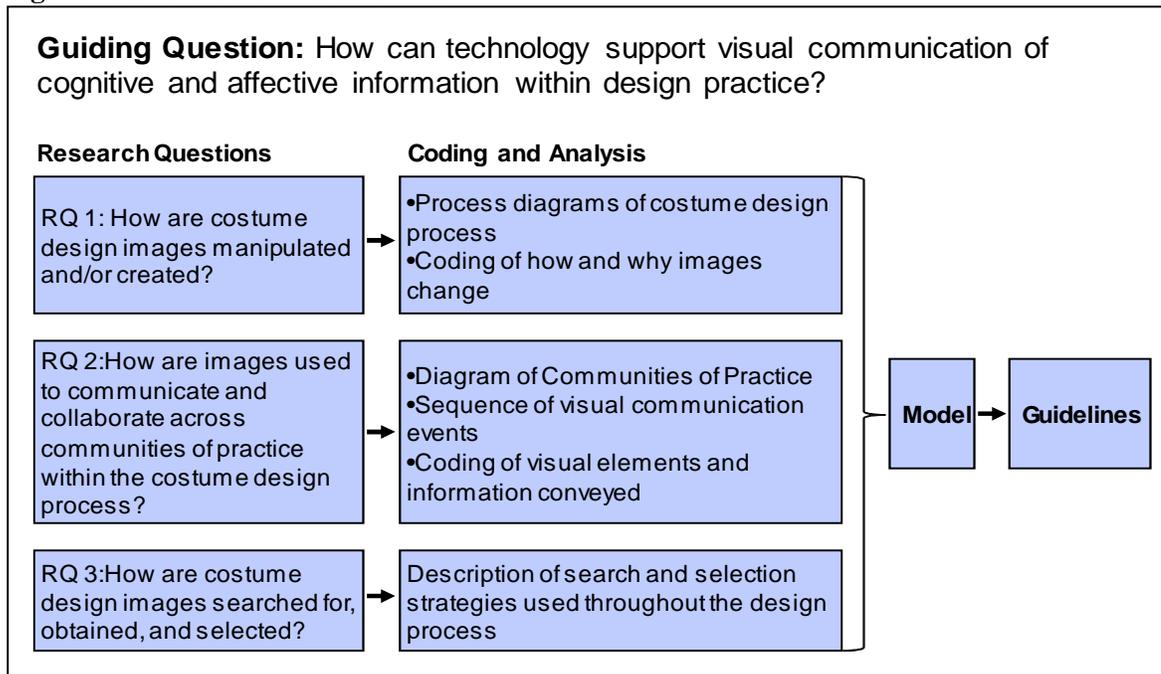
Because this study focuses on negotiated meaning and human processes, the naturalistic assumption of multiple realities was used (Guba, 1981, p. 77). The naturalistic paradigm, under which most qualitative research is conducted, assumes:

- Multiple, intangible realities exist as opposed to a single reality;
- The researcher and participant influence one another ;
- Research leads to working hypotheses;
- Actions occur due to multiple, interrelated factors; and
- Inquiry is value bound (Lincoln and Guba, 1982).

Because this study works within the naturalistic paradigm, overarching generalizations are not attempted; rather, the study results in a model and guidelines for supporting image search, selection, and use within the design process. Further research, likely of a quantitative nature, will be needed to develop generalizable theory.

Figure 1, reprinted below, presents the overall research plan.

Figure 1: Overview of Research Plan



3.2 Research Questions

This study asks:

How can technology support visual communication of cognitive and affective information within costume design practice?

Individuals have different search and communication styles and strategies; however, this study looks for broader patterns within the costume design process. The following, more detailed foreshadowing questions, expanded from those presented in Section 1.4.2 and included in Table 1, guide the study design and data collection.

RQ 1: How are costume design images manipulated and/or created?

- At what point(s) in the design process are images manipulated and/or created?
- At what point(s) are images disposed of?
- With what intention are images created?

- What visual elements are retained through changes?
- What visual elements are included with the intention of conveying certain information?

RQ 2: How are images used to communicate and collaborate across communities of practice within the costume design process?

- What are the communities of practice within the environment?
- Who uses images to communicate?
- What information are images intended to convey?
- How do visual elements and verbal or textual descriptions correspond?

RQ 3: How are costume design images searched for, obtained, and selected?

- What resources do costume designers use?
- How do costume designers select and organize images?
- How do search and selection strategies change as the costume design process evolves?
- What, if any, are the variations in the search and selection process based on the intended image use?

3.3 Case Selection

A pilot study and two additional case studies were conducted. A list of theatres in the Washington metropolitan area was used to identify a pool of potential participants. Purposeful selection was used to choose the cases. Results were compiled for each case individually and then compared across cases. “Each individual case study consists of a whole study, in which convergent evidence is sought regarding the facts and conclusions

for the case; each case's conclusions are then considered to be information needing replication by other individual cases (Yin, 2003, p. 50)"

Certain individuals were present in both case studies. Other theatres in the metropolitan area were contacted about participating in this research but chose not to do so or were inappropriate for the case study in some manner. Although these theatres were identified through a listing of local theatres online and contacted based on their production schedules, the costume designer or costume shop manager contacted had worked with at least one person from one of the three case studies. The relationship of theatre membership was not studied intentionally and the information acquisition was incidental; however, it should be noted that within the region studied, there is likely only one degree of separation between each theatre community. The close-knit nature of this overall community could potentially create similarity in design practice and image use that might affect the results.

The designer in the pilot study described research differences based on whether the play is set within a modern or historical time period and whether or not it includes fantasy elements. The designer stated, "the play always affects how you do [research] because if the play is historically based; you definitely want to look for historical things. If it is something that can have a fantasy element...there could be a fantasy element ...You'd go into other works of art that have a sort of fantasy, unrealistic quality about them...if I was doing a modern play, that would be more looking at magazines, like fashion magazines and watching things on TV."

Modern and historical plays exist within a set time period and require factual research. Cunningham (1984) presents a research strategy for historical plays but

discusses modern plays within a section on special problems. She states that, “research for contemporary plays can sometimes be difficult...research for modern plays may involve visiting areas where persons similar to the play’s characters live (p. 59).” Plays that incorporate fantasy may exist outside a time period, or may be in the past or future (Cunningham, 1984, p. 38-39). Cases were purposely selected to ensure variation in time period as well as the inclusion of some fantasy elements.

Variables based on the setting, play, and individuals involved were also identified during the pilot study. The individual variables (communication style, staff experience, and design methodology) were not accounted for in case selection, but are noted as part of the observations and described in the thick description for each case (See Section 4.1). The setting variables (time available and budget) were considered when cases were selected; but variation was fairly low based on the cases available. The play and setting variables identified in the pilot study are shown in Table 5.

Table 5: Variables Accounted for in Case Study Selection

	Play Variables		Setting Variables	
	Time Period	# of Characters	Time Available	Budget
Case Study 1 (Pilot)	Historical	27	8 weeks	\$650
Case 2	Historical w/ Fantasy Elements	21	8 weeks	\$4000
Case 3	Modern w/ Fantasy Elements	6	12 weeks	\$500

3.4 Data Collection

The study data consist of observation notes, interviews, photographs, and forum postings. Observations were recorded in notes. Interviews were tape recorded and transcribed when possible, but when environmental conditions made recording difficult, notes were taken during the interview and confirmed with the speaker immediately

afterwards. Images collected and created throughout the design process, including the final costumes, were photographed. Electronic communications were printed and compiled in a notebook for future reference. The data collection methods were selected to be as unobtrusive as possible to encourage natural behavior. Because of this, videotaping and think-aloud methodologies were not used.

The researcher conducted an initial interview with the costume designer (See Appendix 1: Interview Questions). The interview focused on understanding how the designer was thinking about the play and the upcoming design process. It also explored the designer’s background including training, education, social networks, and experience as well as the designer’s previous experience with that specific play. All of these factors potentially affected the designer’s approach to the production and are included in the thick description.

After the initial interview, the researcher observed the costume designer’s image search, selection, and use multiple times during the research, design and construction process. The number of observation sessions varied based on the show's complexity, the designer's methodology, and how early in the design process the research began. Table 6 presents a record sheet of observation sessions over the course of each production.

Table 6: Record Sheet of Observation Sessions Over the Course of the Production

Observations occurred during the blue weeks.

Week:	1	2	3	4	5	6	7	8	9	10	11	12
Case Study 1 (Pilot)									/	/	/	/
Case Study 2									/	/	/	/
Case Study 3, Observations												
Postings												

The observations were coordinated with the participants to minimize the impact of the study on their work. The researcher attempted to schedule observations to occur

during various activities throughout the productions' design and development. In the case of the pilot study, later activities were not observed because the pilot originally focused on the costume designer rather than the images. In the second and third case studies, early activities were not observed because the participants did not agree to participate until later in the production cycle. In the case of the second case study this did not greatly impact the researcher's ability to observe the entire design process as bad weather had limited the work that could be done on the play for the first 3 weeks.

In the case of the third case study, observations began very late in the production cycle. Though the time period for observations on this case study was limited, the researcher decided to go ahead for several reasons. First, the case study provided an opportunity to observe a play that was being created rather than recreated and original productions are less frequent than scripted works. Second, the production was created in shorter segments so even though observations occurred late in the overall design process, the researcher was able to observe the creation of several segments being from start to finish. Finally, a great deal of visual communication was conducted on an online forum to which the researcher was granted access and permission to use. This provided a longer record than the actual observations. The researcher attempted to compensate for the loss of observations early on through analysis of the forum, resulting artifacts, as well as through interviews. At the end of the three case studies, the researcher evaluated whether an additional case study was needed, however the data collected and the variables accounted for seemed to provide enough information to meet the study goals.

The researcher requested permission to record discussions between the participants. The researcher also took notes for individual activities and meetings.

When possible, the researcher conducted a brief individual interview with each participant to clarify the researcher's observations and the participant's motivations and thoughts and to understand the participants' next steps. During the final interview, the researcher also asked the participants approximately how long they spent on each task outside of the observation sessions. When participants created new images or collections of images, the researcher photographed the artifacts.

Within a few weeks of the end of the design process, indicated by opening night of the show, the researcher conducted a final interview with each of the participants. Questions were based on the observations, notes, and images, and guided by the theoretical framework. The researcher brought specific examples and images to assist the participant in recalling their thoughts throughout the process.

3.5 Data Analysis

Grounded theory as presented by Straus and Corbin (1990) involves reading qualitative data and assigning codes. Codes are then grouped into concepts, then categories, and finally theories. This method allows theory to evolve from the data rather than being tested a priori. While this approach is considered traditional for qualitative research, Yin (2003) and Miles and Huberman (1994) suggest a more structured approach to aid with developing theories from the data. Miles and Huberman (1994) recommend fitting data into different data displays including matrices, flowcharts, and timelines as well as tabulating the frequency of different events. Yin (2003) suggests three additional strategies: using the original theory to guide data analysis, defining and testing rival explanations, and developing a descriptive framework (p. 111-113).

The research plan presented in Figure 1 takes both Yin's suggested descriptive framework and Miles and Huberman's recommended matrices into account. The plan consists of three parts that directly relate to the research questions and use a combination of coding and diagrams to analyze the data collected:

1. Coding of how and why images change and creating process diagrams of the costume design process.
2. Coding of visual elements and information conveyed, creating a diagram of Communities of Practice, and charting out the sequence of visual communication events.
3. Describing search and selection strategies used throughout the design process.

The researcher coded the data and wrote initial code definitions. Once the researcher was satisfied with the codes, the researcher provided a second coder with the data and a coding dictionary. The second coder then coded the data. In many cases, a single data point for coding consisted of a verbal exchange and the images used during that exchange, leading to a relatively small number of large data points. This situation presented challenges and opportunities: there was not enough data to provide a training set and any deviation had a large effect on inter-coder reliability, but all the data was coded by both coders and the discrepancies can be discussed in detail so that future researchers can improve on the coding.

Once coding was complete, the researcher and second coder then compared results. Inter-coder reliability is reported out in each section as percentage agreements. Because of the nature of the data and because of the exploratory nature of the study, 80% was used as a cutoff for requiring a second round of coding. When the agreement

occurred in less than 80% of the codes, the researcher and coder worked together to refine the coding dictionary. They then both independently recoded the results using the revised coding dictionary. Details of the coding are discussed as part of the results in Chapter 4:. The researcher and coder then discussed the remaining discrepancies and agreed on a code, most often in the coder's favor. Kriplean, Beschastnikh, and McDonald, 2008 present a similar approach although they do not report out the inter-coder reliability since the final result is 100% agreement.

A model for image search, selection, and use in costume design practice was then created and guidelines were written based on the findings. These were sent to the costume designers who participated in the study for a member check. Only the designer from the first two case studies was able to be reached to discuss the findings, but she agreed with both the model and guidelines. Specific comments are included in Chapter 5:.

3.6 *Trustworthiness*

Guba (1981) suggests several strategies for establishing the trustworthiness of results within a naturalistic paradigm.

- First, prolonged engagement, peer debriefing, triangulation, persistent observation, and member checks should be used to handle the complexity of factors that arise in qualitative research.
- Second, collecting and providing thick descriptions and conducting purposive sampling can assist in determining the transferability of the results.
- Third, overlapping methods and creating audit trails can counteract the instability of natural environments.

- Finally, using triangulation, reflexivity, and an audit trail can assist in overcoming investigator bias.

The following methods were used to ensure the trustworthiness of the results:

Purposive sampling

Cases were selected to ensure that the variables which might cause variations are accounted for.

Audit trails

Yin refers to this as a chain of evidence, which allows an external observer to follow the derivation of any evidence from the research questions through the research and to the conclusions (p. 105). This study has been structured to enable readers to begin with the research questions, understand how they relate to the research through the research plan, view the data in terms of both through the theoretical framework, and Appendix 6.

Triangulation of sources and methods

Observations, interviews, and images were all used and analyzed to ensure that any finding is validated through multiple sources.

Prolonged engagement

The researcher conducted interviews and observations at multiple points during the production.

Thick descriptions

A thick description of each case study describing the theatre and participants in detail is provided in Section 4.1 in order to ensure that other researchers can apply the results to similar situations.

Reflexivity

The researcher considers study limitations as part of the analysis and summary.

Member checks

Once the model and guidelines were complete, the researcher contacted the key study participants and asked them to review the results. A short phone interview was conducted to gather their reactions and suggestions. These were noted as part of the results.

3.7 Pilot Study

The methodology outlined above is a refined version of the methodology used in the pilot study discussed below. The pilot study was conducted in the summer of 2007 on a small play. The participating designer was selected because she already had a positive relationship with the researcher and was designing a play within the research time period. The established relationship allowed the researcher to forego much of the trust-building work necessary when conducting a detailed qualitative study. The short time period, 8-weeks, affected the level of research and design conducted, but was ideal for a pilot study because it allowed the researcher to observe the entire research and design process. The play being produced was *The Taming of the Shrew*, set in England between 1592 and 1594. The production budget and costume crew were small.

3.7.1 Pilot Study Foreshadowing Questions

Three foreshadowing questions evolved from the background literature on image search and selection:

- How does image search and retrieval fit into the costume designer's overall design process?

- How does the costume designer search for and select images?
- How does the costume designer use the images selected?

3.7.2 Pilot Study Data Collection

Observations and interviews made up the bulk of data. Interviews were recorded and transcribed. A set of predetermined questions, based on the foreshadowing questions, were used during each meeting; additional questions arose as a natural part of the conversation. When the designer created new images or collections of images, the researcher, with the designer's permission, photographed these images.

The researcher met with the designer three times. The meetings were coordinated with the designer to span the entire design process but minimize the impact the research had on her work. During each session, the researcher took notes on the search and selection strategy, resources and criteria used, and the overall design and research process.

Several questions were addressed before and after each observation session. Before each observation, the researcher asked the designer what she had accomplished since the previous meeting and what she planned on doing during the upcoming session. After the observation session, questions focused on the designer's perception of success and expected next steps. The researcher and the designer determined that short, taped interviews were the preferable means of gathering this data.

The first session occurred after the designer had read the play and held an initial meeting with the director, but before the costume research process began. During the observation session, the researcher focused on understanding the designer's preliminary

perspective on the play and the upcoming design process. After the initial interview, the researcher observed the designer conducting initial online research.

The second session occurred after the designer had met with the director to discuss the preliminary research, but before she created design sketches. During this meeting, the researcher observed the designer conducting research using costume texts and creating a collage of images for each character.

The third session occurred after the costume designs for the show were complete. During this meeting, the researcher conducted a final interview which covered events that had happened since the previous meeting as well as the overall image search and selection process. Additional questions were based on the notes from the previous two sessions, the images used, and the questions that emerged during the study. The researcher brought specific examples and images to assist the designer with recall. The researcher also asked the designer how closely the process she followed mimicked a 'typical' design process.

The resulting transcriptions were coded by the researcher using grounded theory. Initial coding was guided by the foreshadowing questions. The researcher read the data once and used open coding to generate categories. The researcher examined the resulting codes and consolidated them to create a coding structure. Then, the researcher went through the data a second time to ensure that all data had been coded according to the coding structure. The pilot study findings, independent of the full set of three case studies, are located in **Appendix 4: Pilot Study Findings**. The data was all re-analyzed as one of the three case studies after the other two case studies were complete.

3.7.3 Pilot Study Lessons Learned

The initial findings from the pilot study were valuable, but the lessons learned from the pilot study were more so. Some of the most interesting findings centered on the third research question regarding image use, yet the pilot study had centered on the costume designer rather than the images. Because of this, the researcher had not observed many of the collaboration events. The revised methodology reoriented the unit of analysis from the designer to the images themselves.

Because of this, the research questions changed as can be seen below:

Original Research Questions:

- 1) How does image search and retrieval fit into the costume design process?
- 2) How does the designer search for and select images?
- 3) How does the costume designer use images?

Revised Research Questions:

RQ 1: How are costume design images manipulated and/or created?

RQ 2: How are images used to communicate and collaborate across communities of practice within the costume design process?

RQ 3: How are costume design images searched for, obtained, and selected?

The change also refocused the research on images as used by multiple people, rather than just the designer.

The pilot study also brought to light the relationship between verbal discussions and image searches. Additional data collection in the form of taped meetings between the designer and director and costume staff was added to the revised design to capture these events.

The final revision to the study methodology was the removal of the pre-observation interview. The pilot study had both a pre and post observation interview, but the information gathered was repetitive. The initial interview also brought the research context to the forefront rather than emphasizing a natural work environment. While the researcher's presence will always alter the participants' behavior somewhat, starting the observation with a taped interview emphasized that change rather than reduced it. Overall, the methodology worked well and only the revisions discussed above were made to the approach for the second and third case studies.

3.8 Summary : Methodology and Pilot Study

The study's goals of understanding the effects of collaborative and affective image use on image search and retrieval in order to inform system design resulted in the research questions presented in Section 3.4. The relationship between the goals, research questions, foreshadowing questions, and methods is also presented in Table 1.

The pilot study provided an opportunity to test the qualitative methodology. The results led to revised research questions and refocused the research on the image and the communication events in which it is used rather than on the costume designer. Otherwise, the methodology worked well and was used in the major study.

Chapter 4 presents a description of each case study and the empirical results organized by research questions.

Chapter 4: Empirical Results

Overview

- Case Study Descriptions
 - Findings on how costume design images are manipulated and/or created
 - Findings on how images are used to communicate and collaborate across communities of practice within the costume design process
 - Findings on how costume design images are searched for, obtained, and selected
-

This chapter provides a description of each case study and then details the findings for each research question outlined in the methods section. The findings are organized by the foreshadowing questions presented in Section 3.2 Research Questions. Because of the level of detail provided, a summary is provided at the end of the section. If desired, a reader may read through the summaries in order and then read only the detailed subsections needed to better understand the findings.

4.1 *Case Study Descriptions*

A description of each case study is presented including: the type of theatre; the time available; the budget by character; the costume designer's relationship to the theatre and approach to the production; the play's time period, originality, and abstraction; and the designer's background.

4.1.1 Case Study 1 (Pilot)

The first case study was conducted with a costume designer working with a children's summer stock theatre. At the time the research was conducted, she was working on several plays and the designer and researcher discussed which would be practical for a case study based on how far along the designer was on the play and how long until the play was complete. As was stated in the methodology, the pilot study

focused on the designer rather than the images so all the observations and interviews were with the designer for this production. The play being produced was **Taming of the Shrew** and was set in England in 1592. It had 27 characters with a budget of approximately \$24 per character and was produced in approximately 8 weeks. The costumes were historically accurate and realistic in their design.

The designer had worked with the director previously, but not with the costume shop staff. The shop staff worked together for the summer but with various costume designers. The designer was brought in for this production and did not work with the theatre over a longer period of time. Most of the costume designer's research and drawing was done at her home or at another office, approximately 45 minutes away from the children's theatre. The costume designer and director originally decided to design and build the entire production.

The costume designer looked for images at first, "to refamiliarize myself with the time period" but in the same search session selected an image because, "there is this kind of quality to what the show will be...This is going to be good to portray the images to the director too." The designer went through several iterations of research, collaging, and rendering before both the designer and director were satisfied, but they ended up pulling a number of costumes from existing collections because of time constraints.

The costume designer started designing after college where she helped doing wardrobe. She has been designing as her primary profession for approximately 15 years. When she started, she assisted another designer who became her mentor. Her training came primarily through mentoring and she eventually took over her mentor's work when her mentor left for graduate school in costume design. She has maintained contact with

her mentor, who she calls when she has a question. She also occasionally contacts another local costume designer for assistance.

The costume designer is not a member of a formal costume design group but she has informal networks through a stitching group and previous associations. Through these networks, she and others discuss social and technical issues, in-person, via email, or by phone.

4.1.2 Case Study 2

The second case study was conducted with a college theatre producing **Amadeus**, which is set in Austria from 1783-1825. The play was produced in approximately 8 weeks but snow had canceled production meetings for the first few weeks.

The play had 21 characters and a budget of approximately \$190 per character. The production staff was a mix of theatre faculty, students, and professional artists who were brought in to work on this play. The costume designer, who was the same as in the first case study, fell into this final category; however, she had worked with this theatre for a number of years. All of the theatre faculty and professional artists knew each other well and had worked with each other previously. The actors, various backstage roles and the costume shop staff were theatre students. They knew each other and most had worked on a previous play with the theatre faculty and professional artists.

When the costume designer and director first met to talk through the costumes, they discussed the number of costumes for people and the colors. The director said, “simple, simple.” The designer and director decided to primarily pull the costumes from existing collections and supplement with custom-built pieces as needed. The costumes

were historically accurate and realistic in their design, although the production includes some fantasy elements within a masquerade scene and a dream sequence.

On this production, most of the observations and interviews were conducted in the theatre's costume shop or green room. Production meetings were held Friday evenings in the green room directly before rehearsals and the costume designer would often get to the theatre mid-day on Fridays to get started, go to the production meeting, and then meet with actors and the costume shop staff after the production meeting was complete.

4.1.3 Case Study 3

The third case study was conducted with a professional theatre company who was creating an original work. The play had 6 characters with a budget of approximately \$83 per character. The costume designer was also the director and the entire group had worked together for a number of years. Ideas for the play had been discussed as early as a year before, planning began in earnest about 12 weeks before opening night, and rehearsals started a few weeks after that.

The play was an original work and the setting and costumes evolved with the production. The approach to creating this production was very different from the approach used in the first two case studies. No script existed, and the production evolved through collaboration between the actors, directors, and other artists. They used a method called "Viewpoints," based on a technique by Anne Bogart. The artistic director explains the approach as: The ensemble creates "live images" during exercise work. They create images, specific stage pictures, through warm-up exercises and the director then takes the generated images and infuses it into the main stage show. Within this methodology, images played a central role, not only in conveying information about the

costume designs but also in developing the scripts which the designs supported. Images were used as a starting point for the script and as costume pieces were developed, they fed into the image work that then developed into the play. Videos were also used in this production as the mechanism for recording and thereby formalizing the “script” once it had been created.

Observations most often occurred in the main theatre space as the production evolved and interviews were conducted in adjacent office space. The time period and setting were contemporary, but abstract, centered on an insect theme. Some costumes were pulled from an existing collection and others were built from scratch.

The costume designer for the third case study has a theatre degree from a local university which included general costume classes and she has also been designing periodically for approximately 15 years. When she needs assistance, she uses informal connections with other company members who, “are a little more costume centered,” as well as artistic family members.

4.1.4 Summary: Case Study Description

Twenty-five participants were observed and interviewed for this research. One individual participated in both Case Studies 1 and 2. Two individuals participated in both Case Studies 2 and 3 (See Section 4.3.1 for more details.) In total, Case Study 1 included one participant, Case Study 2 included 18 participants, and Case Study 3 included ten participants. The majority of professional designers, directors, and actors were in their late 30's or early 40's. A few were around 60 years of age. They had all worked in theatre for a number of years. The theatre students in case study 2 were around 201. Twenty of

¹ Exact demographic details are not included for confidentiality reasons.

the participants were women and five were men. Participants typically owned their own computer and had access to one through their work or school. Participants in the third case study had been using computers as a means of documenting and communicating their theatrical practices for several years.

The age range may be worth noting because technology use is currently in a state of transition. With the exception of the theatre students, participants had a great deal of experience within their theatrical skill but did not grow up with the level of technology now available. In ten years time, more experienced theatre professionals will fall into the generation which grew up using computers and the internet. This may affect the frequency and ways technology is used in theatrical processes.

Table 7 presents a summary of these variables and is repeated at the beginning of each major section of findings for cross reference.

Table 7: Summary of Case Study Variables

	Case Study 1 (Pilot)	Case Study 2	Case Study 3
Time Period	Past	Past	Contemporary
Originality	Frequently Performed	Frequently Performed	Original Work
Abstraction	Realistic	Realistic w/ Fantasy Elements	Abstract w/ Fantasy Elements
Costuming Strategy	Most built, some existing	Most existing, some built	Equal amount existing and built
Budget/Character	\$24	\$190.00	\$83.00
Time Frame	8 weeks	8 weeks	12 weeks
Designer	Designer 1		Designer 2
Theatre Type	Children's Theatre	College Theatre	Professional Ensemble

4.2 *Image Creation and Manipulation*

This section addresses the following foreshadowing questions:

- At what point(s) in the design process are images manipulated and/or created?
(4.2.1)
- At what point(s) are images disposed of? (4.2.2)
- With what intention are images created? (4.2.2)
- What visual elements are retained through changes? (4.2.2)

The foreshadowing question, “What visual elements are included with the intention of conveying certain information?,” is addressed in Section 4.3.4.

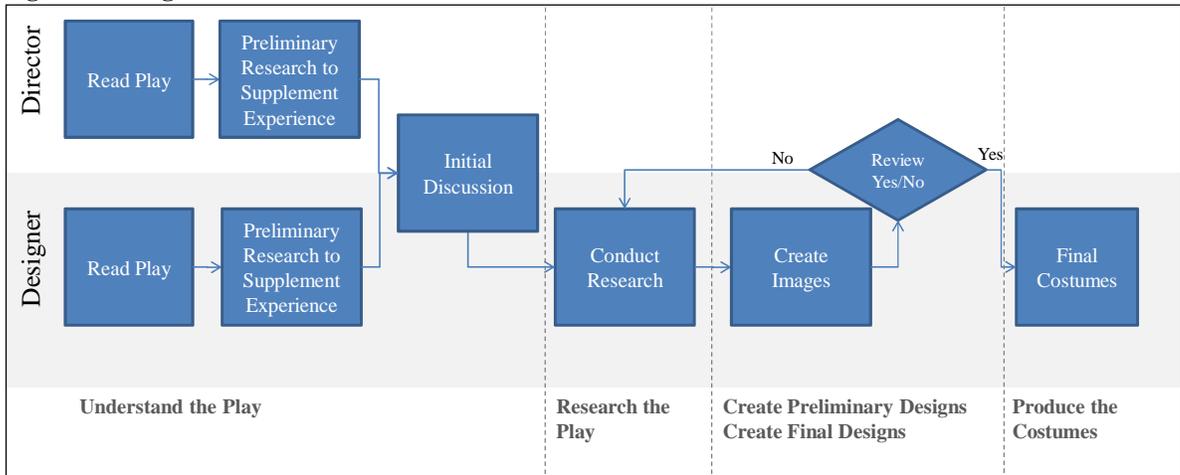
Table 7 (Repeated): Summary of Case Study Variables

	Case Study 1 (Pilot)	Case Study 2	Case Study 3
Time Period	Past	Past	Contemporary
Originality	Frequently Performed	Frequently Performed	Original Work
Abstraction	Realistic	Realistic w/ Fantasy Elements	Abstract w/ Fantasy Elements
Costuming Strategy	Most built, some existing	Most existing, some built	Equal amount exiting and built
Budget/Character	\$24	\$190.00	\$83.00
Time Frame	8 weeks	8 weeks	12 weeks
Designer	Designer 1		Designer 2
Theatre Type	Children’s Theatre	College Theatre	Professional Ensemble

4.2.1 **Costume Design Process**

The design process for the third case study differed from the first two case studies. In the first two studies, the designer conducted the majority of research and design and presented her ideas in the form of images or costumes, primarily to the director. The design process for the first two productions followed the model shown in Figure 3: Design Process in Case Studies 1 & 2.

Figure 3: Design Process in Case Studies 1 & 2



This model closely mimics the model presented in the costume design texts read in preparation for this research which has five stages (See Appendix 3: Summary of Design Stages):

- 1) Understand the play: The costume designer reads the play and meets with the director and often other designers.
- 2) Research the play: The costume designer researches the clothing practices and tone of the production.
- 3) Create preliminary designs: The costume designer creates initial images which may include thumbnail sketches, preliminary sketches, color layouts, and/or fabric swatches and collaborates with the director and other designers.
- 4) Create final designs: The costume designer creates final renderings of the costumes.
- 5) Produce the costumes: The costume designer and costume shop staff rent or pull costumes from existing collections as well as select fabrics and patterns to create original costumes.

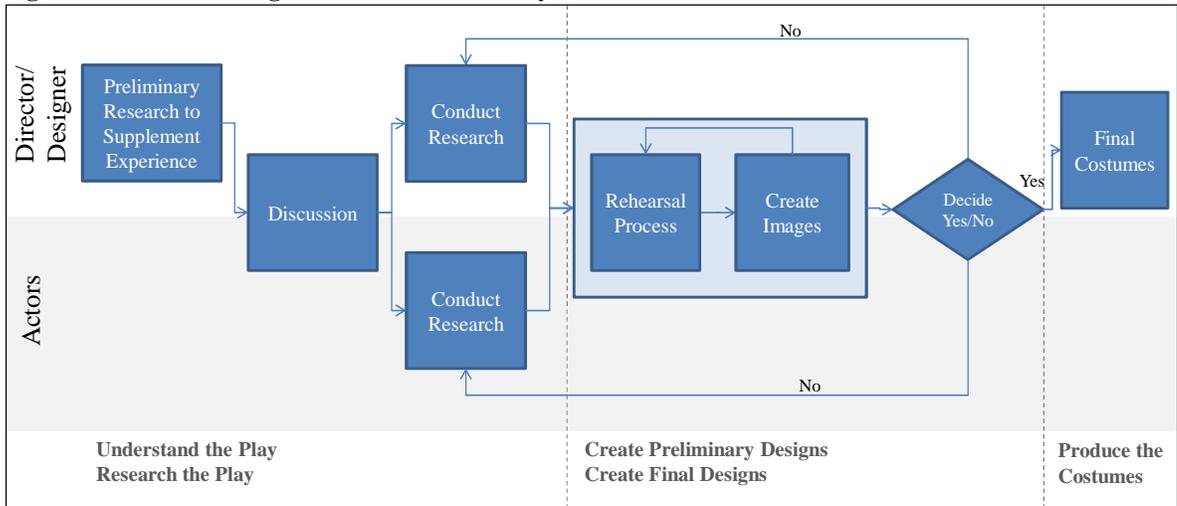
The primary difference between the textbook process and the observed process was that in reality, if approved, preliminary designs would become final designs or, in the case when a costume was pulled from an existing collection, the costume itself acted as the preliminary design, the final design, and the resulting costume.

The costume design process in the third case study was less linear and more collaborative. No play existed and the script was written through the rehearsal process. The actors as well as the costume designer/director conducted research. This research was conducted independently, and is presented in separate boxes in the diagram to reflect this. The research was fairly continuous throughout the production and fed into the rehearsal process and image creation. Images were created and refined through the rehearsal process, starting with mental images and leading to prototypes and a final set of costumes. Small corrections were made as part of the rehearsal process until a final product was agreed upon. When describing the evolution of larvae tubes used in the production, the costume designer/director stated:

We'd been working with things that [the actors] didn't actually get into so they couldn't work with the tubes for a while. They had bands that they were working with when they got caught up in the web, but I made up a mockup of one and said try this to see if it was the right height and things like that. I actually made a couple because I didn't know... how long I had to make it in order for them to get into it and then when they were on the ground for it not to be too long. So they wouldn't get caught up in it when they had to move across the floor in it. So I actually was able to choose from which one worked the best. And once we got them, they are, once again, terrific to work with so we just spent a little bit of time working with the tubes. Playing I think... Trying to finesse the tubes.

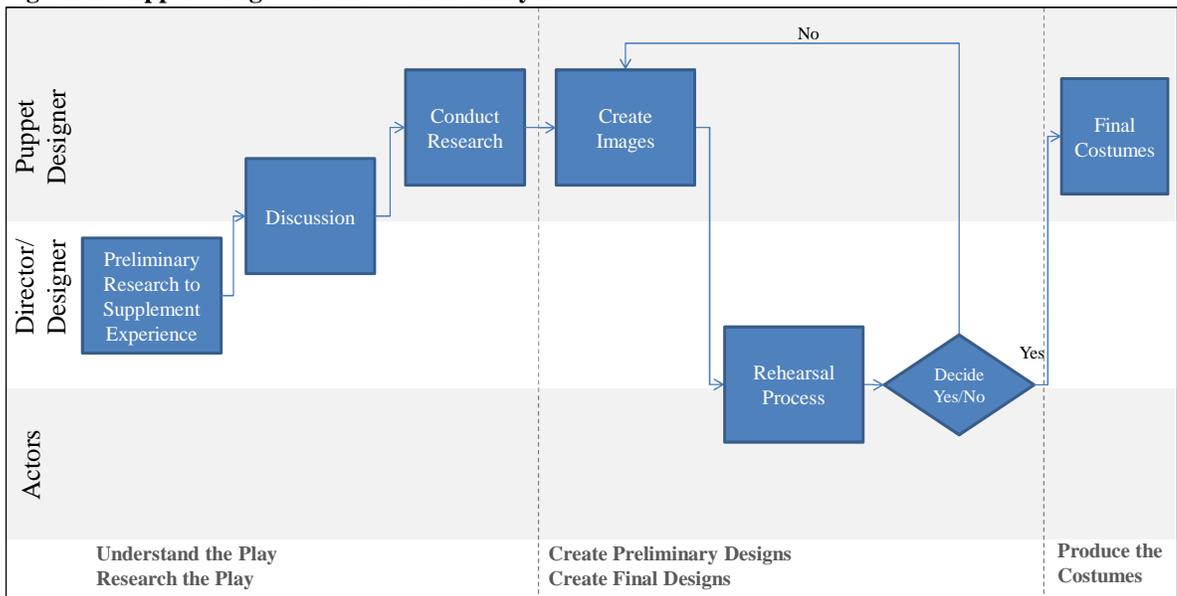
The process generally used in Case Study 3 is presented in Figure 4.

Figure 4: Costume Design Process in Case Study 3



The exception to this process was the Mantis Puppet that was designed by a different designer, slightly removed from the ensemble and rehearsal process. Figure 5 presents the mantis design process. In this case the process more closely resembled the process from Case Studies 1 and 2.

Figure 5: Puppet Design Process in Case Study 3



There are several possible reasons for the difference between Case Studies 1 and 2 and Case Study 3. In Case Study 3, the costume design process was part of a

collaborative, evolving theatrical process in which the production itself was created from scratch, rather than re-presented from an existing script. The trust level of an established theatre ensemble allows for more experimentation and input from multiple members. Also, the designer and director were the same person, so an external decision point between the designer and director did not exist. Decisions evolved from the group's rehearsal process.

In all three case studies the line between creating preliminary designs and creating final designs was difficult to distinguish. In the third case study, the line between understanding the play and researching the play was also ambiguous. To clarify analysis by costume design process, the stages have been condensed into three stages:

- 1) **Understand and research the play:** The costume designers read the play; conduct research into the time period, clothing practices and tone of the production; and meet with the director and often other designers.
- 2) **Create designs:** The costume designers create and refine images which may include thumbnail sketches, preliminary sketches, color layouts, fabric swatches, prototypes, or even potential costumes. During this stage the designer collaborates with the director and other designers.
- 3) **Finalize the costumes:** The costume designers and costume shop staff select fabrics and patterns to create original costumes; refine prototypes until satisfied with an end result; or select final costumes from previously chosen options and fit these to the actors.

4.2.2 How and Why Images Change

In all three case studies, after initial images were created, they evolved in a variety of ways. These evolutions are illustrated in a similar cyclical pattern in Figure 3, Figure 4, and Figure 5. This section explores how images evolved as part of the design process.

4.2.2.1 Examples of Image Evolutions

Case Study 1: Kate and Bianca from *The Taming of the Shrew*

The costume designer described the evolution of Kate's and Bianca's costumes as follows [some text has been omitted to improve readability]:

I went through all of my costume books for that particular time period to see what the actual historical garments were, based on paintings and letters. Then I proceeded to pair them into groupings to what I envisioned the characters to look like. That's how I got my collages. I would assign different dresses or different looks to the people in the pictures. So I thought, this seems to be Kate, this seems to be Bianca based on the type of dress and what I envision they could be wearing on stage.

Figure 6: Costume Designer's Collage of Bianca and Kate



Then I took [the collages] to the director and she said yes or no. If she said no, I went back and tried to do some more research and find other images on some of them. On some of them I just went through and just changed bits and pieces, especially if she was like, “Overall I like where she’s going but she needs to be like this.”

Then there is actually a set of renderings that I did where the colors were off, so I had to go back through and recolor them, a lot of them, because they had too much color, or they weren’t really the right color. There was a reason she wanted certain colors. Like Bianca, I did in a pale blue. And then she said, she’s Bianca, she should be white. But then I said, yeah, but you told me before that you wanted them to be the cool colors because they are the cooler couple, I see as colder, so that’s why I think she should be in blue with a lot of white showing through. Then she was like, “Yeah, oh, that does make sense.” I had to redo the renderings so

she was more white and take some of the blue out. I had blue bows on her and I had to make them white bows.

Figure 7: Costume Designer's Kate and Bianca Renderings



Because of the budget [the patterns] had to be the McCall's and Butterick that were really cheap whereas I'd prefer to have the Period Patterns that were a lot more detailed. And then, even though I drew this having a zigzagged archiness, that didn't happen in the final product. They did it straight across like in the pattern.

Case Study 2: Venticelli Masks from Amadeus

The costume designer located images from Internet searches (See Figure 8). She provided a group of these to the director who eliminated one from the group. The designer further refined the set to images that used materials, "accessible to me and the students," to inspire a set of "rough thumbnails" (See Figure 9).

Figure 8: Mask Images from Internet Search

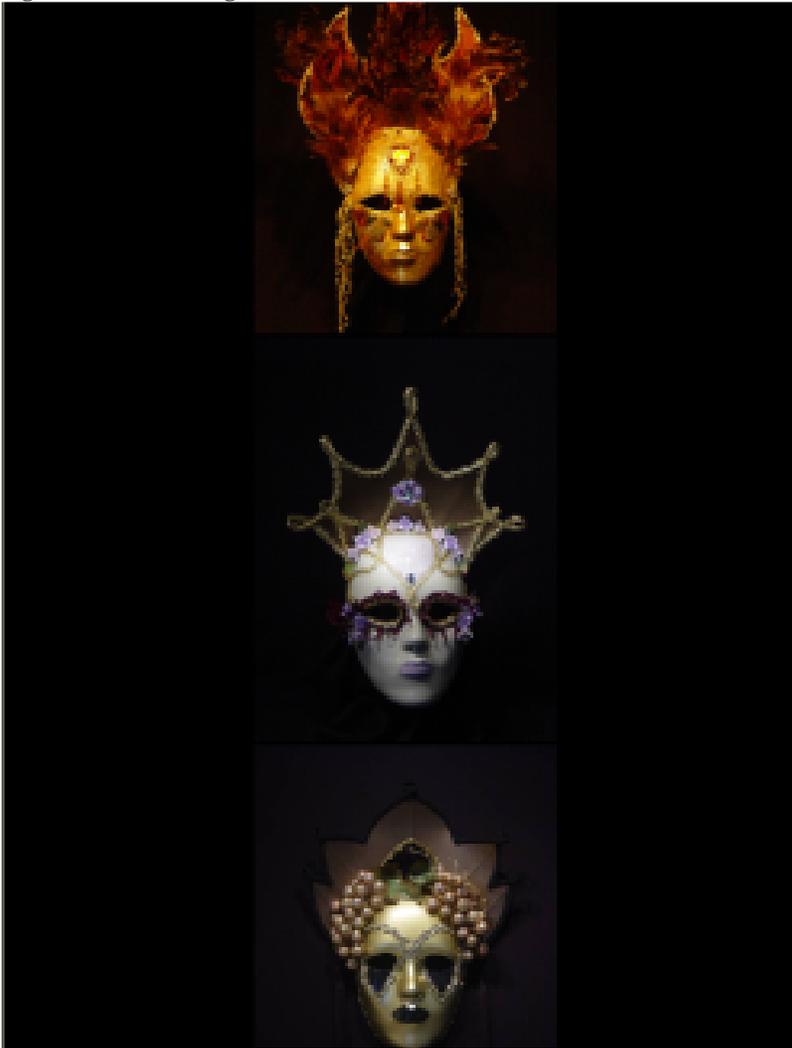


Figure 9: Rough Thumbnails of Masks



The costume designer then used the thumbnails to purchase materials and then created final renderings based on those materials (See Figures 10 and 11).

Figure 10: Mask Materials Purchased



The materials were then provided to the costume shop staff with instructions, “Go by this [drawing] but if it isn’t going to work, play with this [mask and supplies] and change it.” During the creation of the mask, the following conversation occurred between the mask builder and costume designer resulting in the final product (Figure 12).

Mask Builder: “Do you want eyelashes on the bottom too? Because it’s kind of close.”

Costume Designer: “Yes.”

Mask Builder: “I could just take one and [held trim up to the mask].”

The costume designer agreed and the final mask has fewer eyelashes below the eyes than the final rendering.

Figure 11: Final Mask Rendering

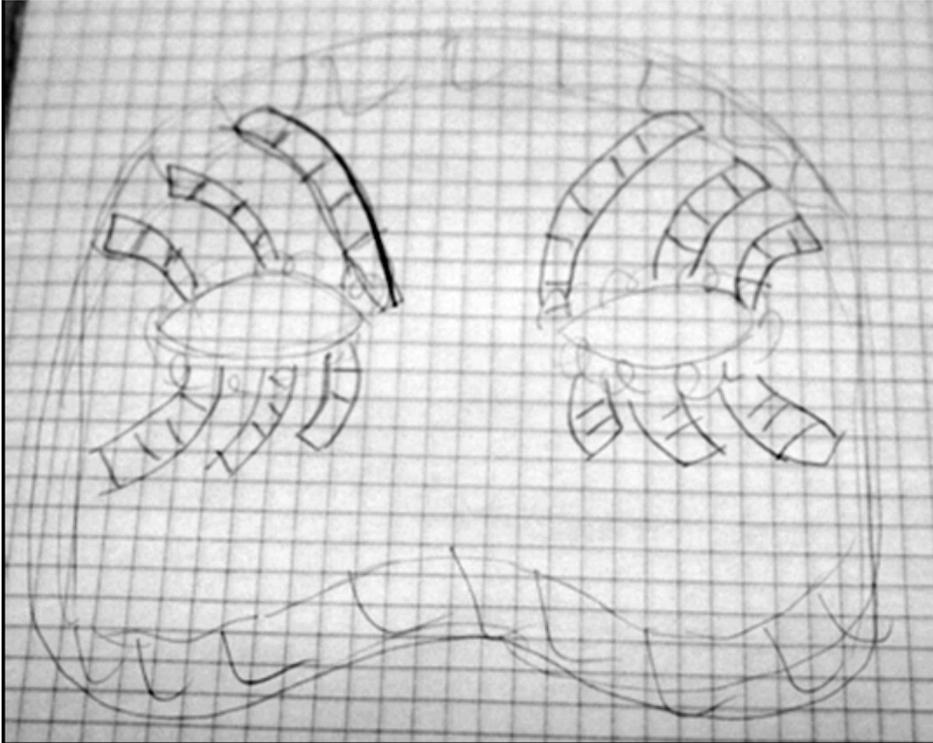


Figure 12: Final Mask



Case Study 3: Insect Armor/Shells from an original production

The costume designer/director illustrates how the rehearsal process, research, and costume design process interact in the third case study [some text has been omitted and reordered to improve readability]:

Earlier on I had this idea that [the set designer] and I talked about a lot of having these pieces of armor or shells that [the actors] would put on and take off to show the exuviae, the shedding. That was one of the things that changed for me at the very end, just figuring out how I wanted to end the piece. [While] watching what [the actresses] had done in rehearsal, we were working on something else, and I watched a clip of something. One of the actresses was trying to show me an example of [a movement] that we were trying to put somewhere else. When I saw that, I immediately said, "I know what I want to do for the end of the show." So it was inspired by some dance thing or mime technique that I saw. I think that [the shells] would have been cool, and I think it would have been another layer of textural and visual elements, but because it's such a strong movement piece that their final exuviae movement, that they do with just their bodies, is kind of more of what I think the piece deserves. Because of what the women have been through in the movement, it's more of an inner journey so it didn't need that literal physicalization of it.

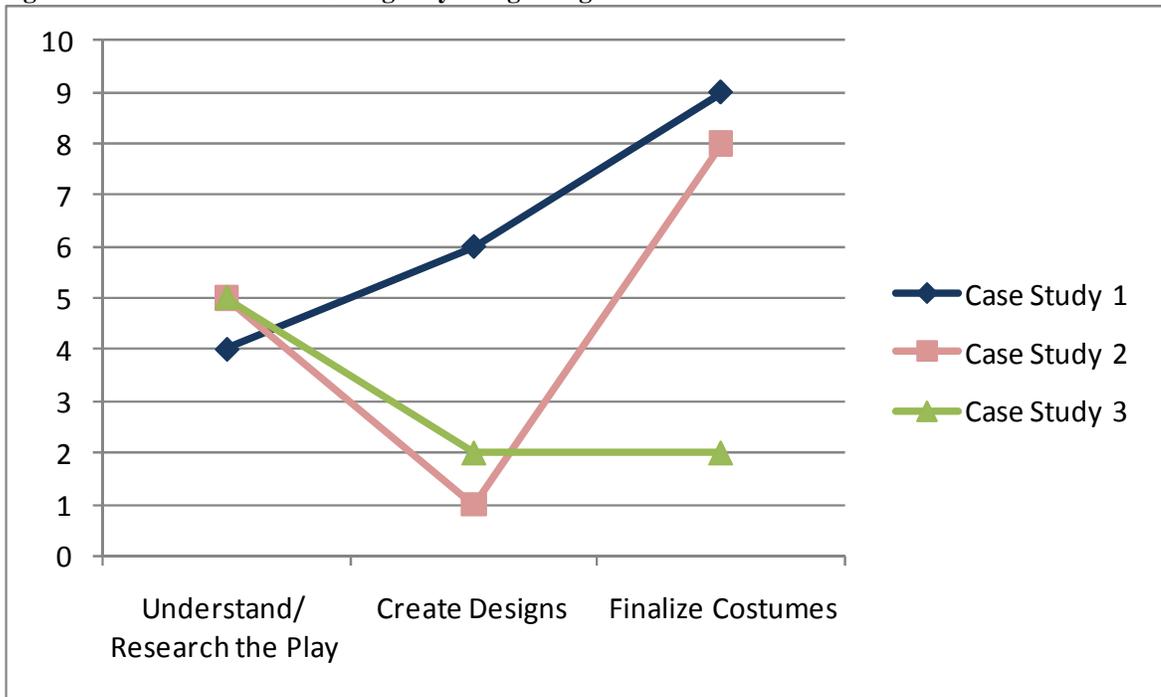
4.2.2.2 Reasons Images Change

The examples above illustrate some of the ways images evolved into costumes during the case studies. By nature of the design process, all images must eventually change format into a physical costume. These changes are not noted in the analysis

below. Outside of this change, there were 19 changes noted in the first study, 14 changes noted in the second study, and 9 noted in the third study. Only changes that were described by a participant or directly observed are included. It is highly likely that additional changes occurred but were not recorded as part of an observation or interview session.

Figure 13 presents the number of changes that occurred in each design stage. In Case Study 1, the number of changes increased as the production progressed. The majority of changes in the second case study also occurred at the end, but there were fewer changes during the design stage than in the first case study. When comparing Case Studies 1 and 2, the fact that the designer was the same person did not seem to affect the pattern of changes across design stages, indicating that the play or setting variables are likely more important. The different pattern may reflect a difference between a production where the majority of the costumes are designed as compared to a production where the majority are pulled from existing collections; or it may reflect the longer term, more trusting relationship between the designer and director in the second case study. The third case study shows the opposite pattern where the number of changes decrease as the production progressed. This may be due to the collaborative, evolving nature of the third production.

Figure 13: Total Number of Changes by Design Stage



Both the Type of Change that occurred and the Reason Images Changed were coded. In both cases, data was coded two times to reach 80% correlation or greater between the two coders. Occasionally, two reasons were given for the Type of Change and both were coded, so the number of reasons is greater than the number of changes.

The Types of Changes noted fell into the following categories:

- **Alteration:** Changing part of the content of an image to create a new image. The individual altering the image kept aspects of original image in some form. Typically this applied to a single image.
- **Re-conceptualization:** Changing the whole idea behind an image or replacing an image or set of images with a new image or set of images. In this case, an idea was created or presented and then changed.
- **Elimination:** Disposing of an image entirely. Typically this applies to one or more images from a set of two or more images.

- **Format Change:** Changing the format of the image without changing the content. An example of this would be photographing a sketch. The content did not change but the format is now a photo rather than a sketch.

The final inter-coder reliability for the Types of Changes was 86%. Five of the six discrepancies that occurred in the Type of Change always included Re-conceptualization by one coder and either Alteration or Elimination by the other. This highlighted that the code for re-conceptualization represents the extreme example of the other codes. Despite the potential for ambiguity, Re-Conceptualization should remain independent of the other codes. Unlike Alteration and Elimination, which typically refine existing work, Re-conceptualization indicates a drastic shift in the approach to an image and often represents additional work for the designer and backtracking within the design process.

Instead of resolving this difference in coding before charting the results, Figure 14 presents the types of changes in each case study assuming the discrepancies resolved to Re-conceptualization and Figure 15 presents the types of changes assuming the discrepancies resolved to Alteration or Elimination. Regardless of how the discrepancies are resolved, Alterations account for the majority of changes.

Figure 16 and

Figure 17 present the changes broken out by costume design stage, independent of the case study in which they occurred. Regardless of which way the discrepancies are resolved, the trends remain the same. The number of Alterations increases dramatically as the costume design process progresses. The number of Eliminations remains constant in the first two phases but drops off in the final stage.

Figure 14: Types of Changes, Discrepancies Resolved to Re-Conceptualization

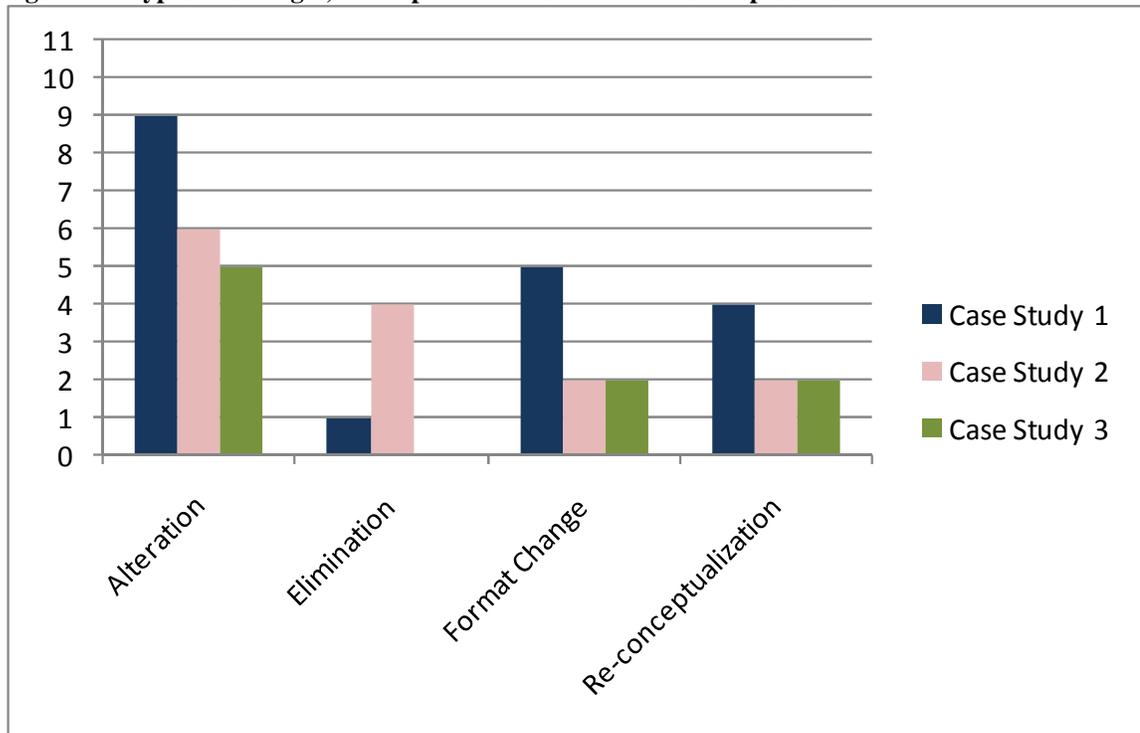


Figure 15: Types of Changes, Discrepancies Resolved to Alteration or Elimination

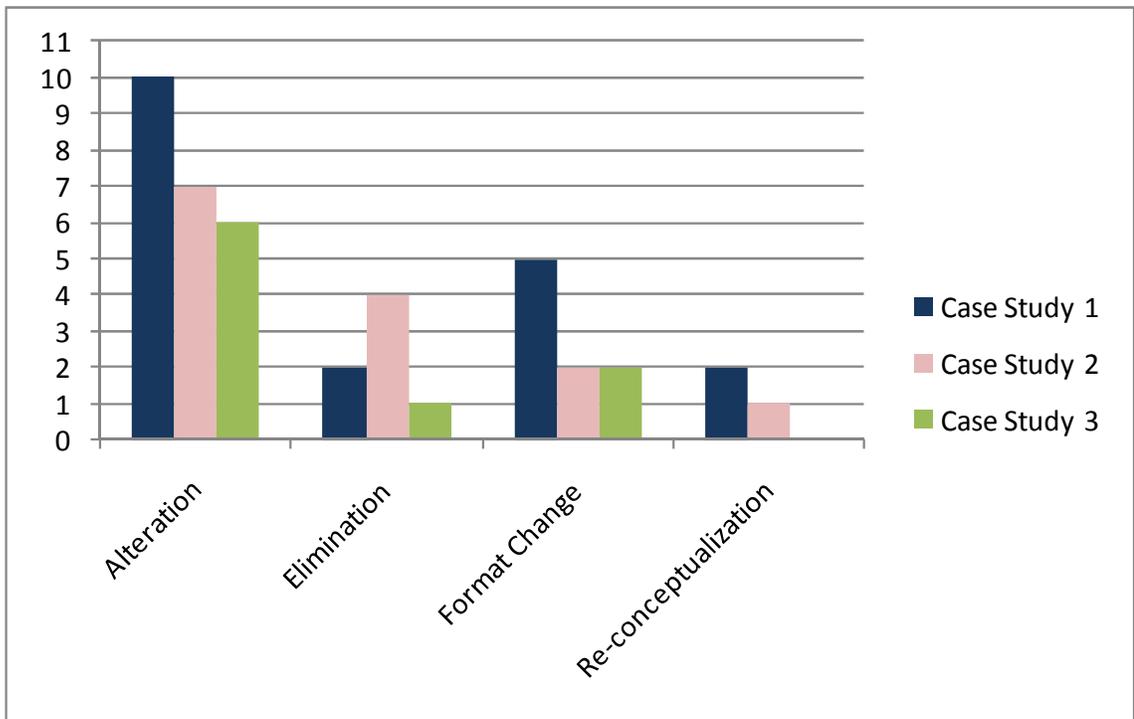


Figure 16: Changes by Costume Design, Discrepancies Resolved to Re-conceptualization

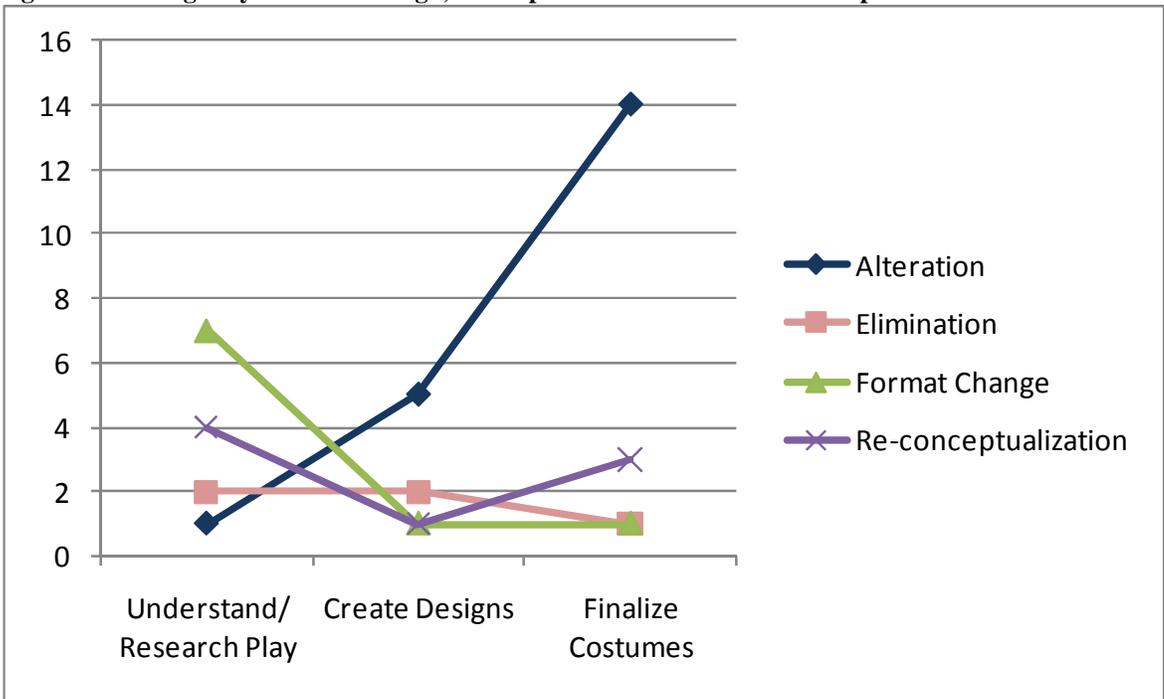
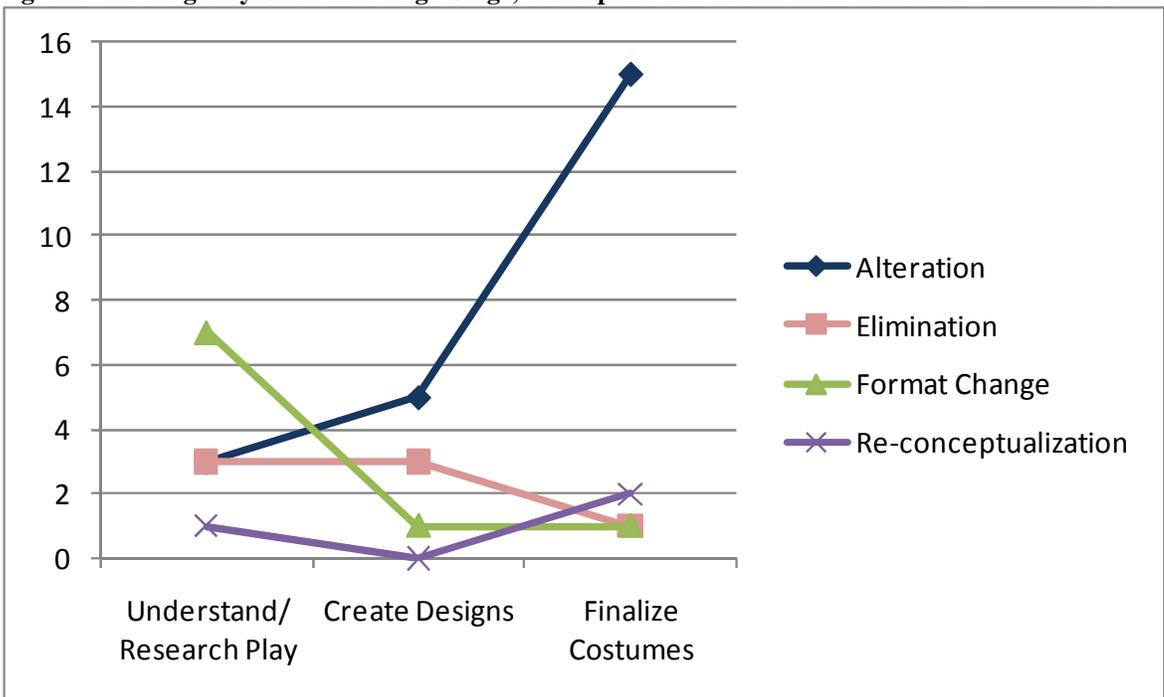


Figure 17: Changes by Costume Design Stage, Discrepancies Resolved to Alteration or Elimination



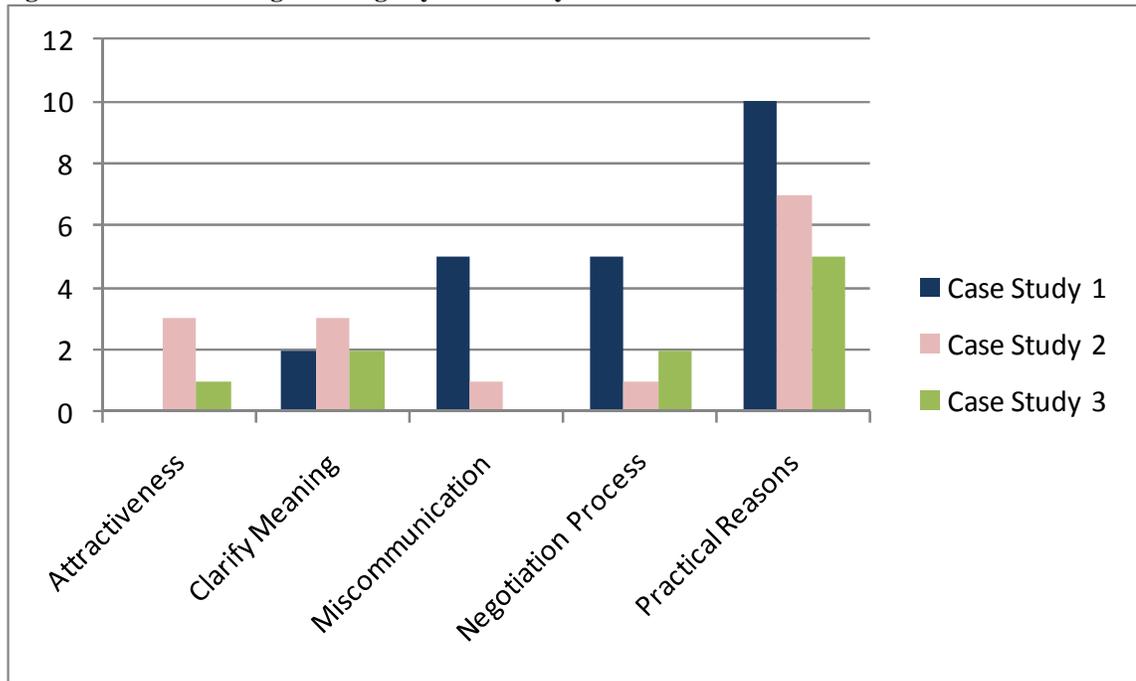
The number of Format Changes decreases after the first phase and remains constant in the last two stages. This is because the majority of format changes were printing images found on the computer and this was done during the research phase. Re-conceptualizations occur less frequently during the Create Design stage than in the other two stages.

Images changed for the following reasons (bold indicates coding label):

- **Negotiation Process:** The change resulted from discussions between participants in the design process. The change occurred during a discussion or as a direct result of the discussion.
- **Clarify Meaning:** The change was made in order to better articulate or clarify meaning. This might be a change made to one image or costume to better fit with other costumes or the overall production. The change typically occurred before or in anticipation of a discussion or presentation.
- **Practical Reasons:** The change occurred because of a practical constraint such as time, availability, skill, mobility, or because elements did not physically fit together or work as expected.
- **Miscommunication:** The change resulted from a misunderstanding between parties involved in the design and execution of a costume. This applied to any mention of communication difficulties, misunderstandings, or surprise resulting from communications.
- **Attractiveness:** The change was made to improve the appearance of the costume or wearer.

The final inter-coder reliability for the Reason Images Changes was 89%. In this case no single code stood out as causing the discrepancies and codes were resolved through discussions between the two coders.

Figure 18: Reasons Images Change by Case Study



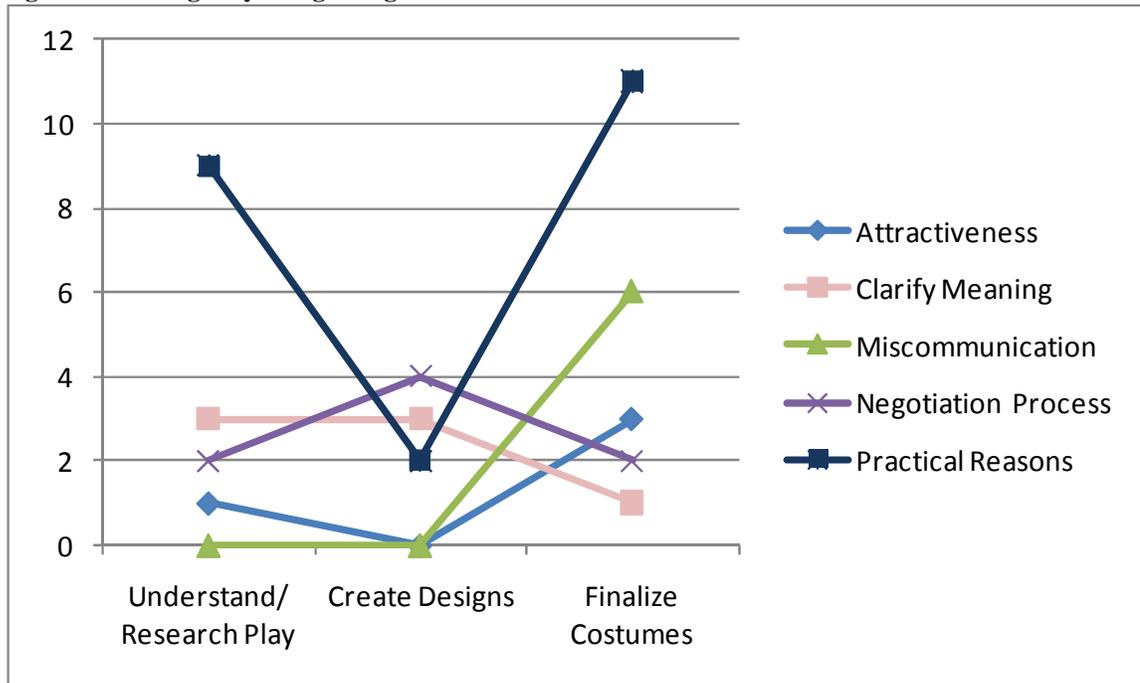
The primary reason for changes in all three case studies was for practical reasons

(see Figure 18). Again the pattern for Case Studies 1 and 2 differs, indicating that differences in visual changes may be more dependent on the production or setting than the designer.

Figure 19 shows the pattern of changes by stage across all three cases studies. Changes for practical reasons occurred in the initial phase when images were printed for mobility, dropped off during the second stage, and increased again during the third stage when costumes were finalized. During the third stage, changes often occurred because of compromises with materials when an item was being built as happened in the example from Case Study 2 above or because an existing costume was found that saved time and would work instead of the originally intended design. Miscommunications only occurred

in the third stage and almost always occurred between the costume designer and the costume shop staff. At the same time, image changes as part of the negotiating process and to clarify meaning drops off while costumes are being finalized.

Figure 19: Changes by Design Stage Across Case Studies



4.2.3 Summary: Image Creation and Manipulation

The process used to design costumes in Case Study 1 and Case Study 2 closely resembled the design process described in costume design textbooks. Both the designer and director read the play and then conducted research before holding an initial discussion. The designer then conducted additional research in the form of image searches in the case of the play that was primarily built and costume searches in the case of the play that was primarily pulled from existing collections. The resulting images were then brought to a negotiation between the designer and director which led to refined images/costumes. This refinement process continued until it resulted in a final costume. A similar process was used by the puppet designer in Case Study 3.

The other costumes designed in Case Study 3 followed a slightly different process. In this case, research and discussion fed into a rehearsal process. Images were created during the rehearsal process and supplemented with additional research. These images then evolved as part of the rehearsal process until a final costume resulted. Based on observations, the textbook description of the costume design process was reduced from five stages to three:

1. Understand and research the play,
2. Create designs, and
3. Finalize the costumes.

Across the three case studies, images changed in one of four ways and for one of five reasons. Examples of these categories from the data are below.

- **Alteration to increase Attractiveness:** Jewelry was added because without it, the resulting costumes looked “naked.” (Case Study 2)
- **Elimination as part of the Negotiation Process:** The director removed a mask image from a set of images presented by the designer while discussing what the final masks should look like. (Case Study 2)
- **Format Change to Clarify Meaning:** The costume designer switched from collages to renderings to, “get the idea across.”
- **Format Change for Practical Reasons:** The hairstylist photographed an image from the costume designer so she would have it available to work from (Case Study 2)
- **Re-conceptualization due to Miscommunication:** The costume constructed was completely different from the one designed. (Case Study 1)

In the final stage of the costume design process, when time often grows short on a production, the number of changes for practical reasons and due to miscommunications increased while the number of changes to clarify meaning or as part of a negotiation process decreased. This suggests that collaboration may decrease as the design stages progress. The number and type of changes made to an image seemed to depend more on the production or setting variables than on the designer.

4.3 *Image Communication and Collaboration*

This Section addresses the following foreshadowing questions:

- What are the communities of practice within the environment? (4.3.1)
- Who uses images to communicate? (4.3.1)
- What information are images intended to convey? (4.3.2)
- How do visual elements and verbal or textual descriptions correspond? (4.3.3)
- What visual elements are included with the intention of conveying certain information? (4.3.3)

In addition, this Section presents findings on the use of gesture and body movement in visual communication. (4.3.4)

Table 7 (Repeated): Summary of Case Study Variables

	Case Study 1 (Pilot)	Case Study 2	Case Study 3
Time Period	Past	Past	Contemporary
Originality	Frequently Performed	Frequently Performed	Original Work
Abstraction	Realistic	Realistic w/ Fantasy Elements	Abstract w/ Fantasy Elements
Costuming Strategy	Most built, some existing	Most existing, some built	Equal amount existing and built
Budget/Character	\$24	\$190.00	\$83.00
Time Frame	8 weeks	8 weeks	12 weeks
Designer	Designer 1		Designer 2
Theatre Type	Children's Theatre	College Theatre	Professional Ensemble

4.3.1 Communities of Practice

Figure 20 presents the communities of practice in each case study. Some individuals filled multiple roles and sometimes multiple people filled a single role. The gray circles indicate that the individual(s) in question did not participate in the study. Some individuals belonged to additional communities such as theatre students. These communities are indicated by the boxes.

Figure 20: Communities of Practice

Gray indicates the individual(s) were not interviewed; (#) indicates the case study

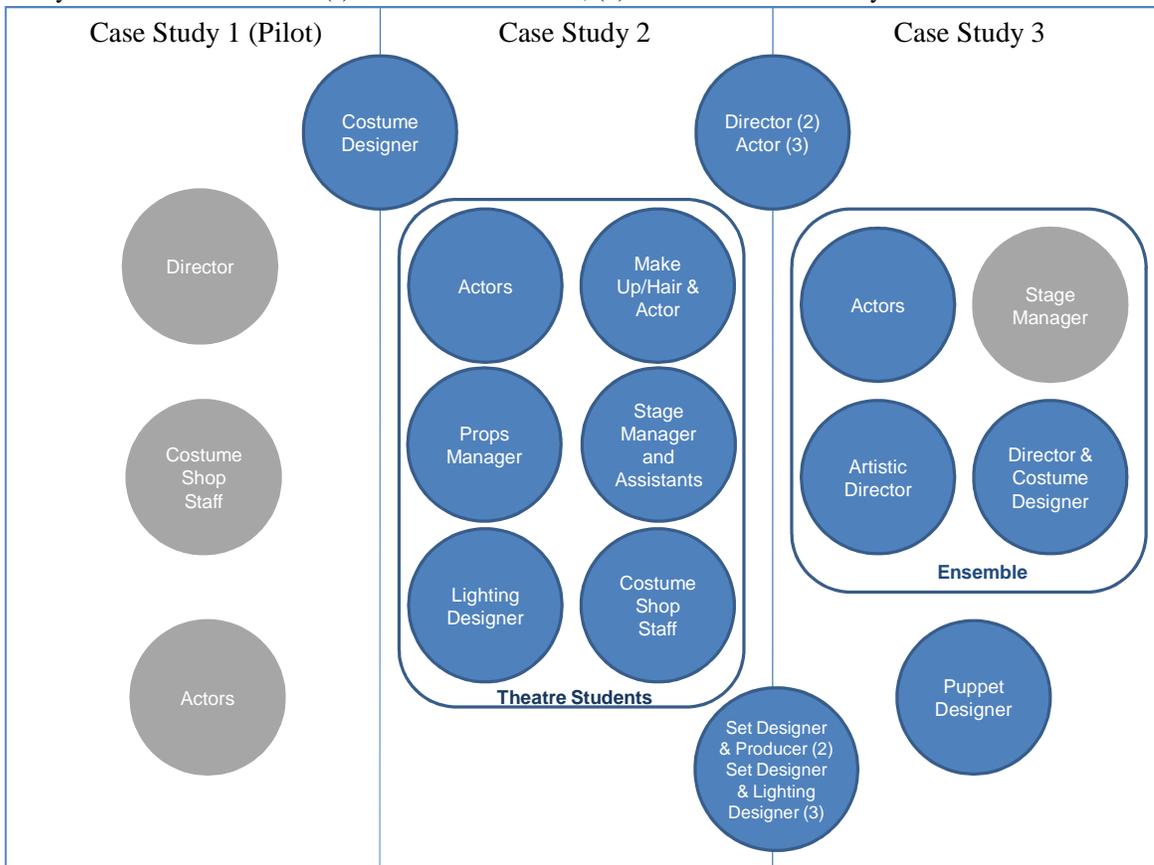


Table 8 lists visual communication events that occurred across these communities of practice. Other events were observed but did not utilize images. In the table, the sender is the person who brought the images with the intention of communicating with the receiver.

Table 8: Visual Communication Events

# of Events	Sender	Receiver
Case Study 1 (10 events total)		
7	Costume Designer	Director
2	Costume Designer	Costume Shop Staff
1	Director	Costume Designer
Case Study 2 (11 events total)		
3	Costume Designer	Director
3	Costume Designer	Actors
1	Costume Designer	Producer
1	Director	Costume Designer
1	Actor/Hairstylist	Actor
1	Lighting Designer	Costume Designer, Stage Manager
1	Costume Designer	Costume Shop Staff
Case Study 3 (32 events total)		
15	Director/Costume Designer	Ensemble
11	Actor	Ensemble
2	Director/Costume Designer	Actors
1	Actor	Actor
1	Director/Costume Designer	Set Designer
1	Puppet Designer	Ensemble
1	Set Designer	Ensemble

In the first two case studies, the majority of visual communication events occurred among the individuals, while within the third case study, the majority of the communication occurred between an individual and the larger community of practice. While this is partially due to the use of the forum communication, it also reflects the collaborative nature of the design process used in the third study.

4.3.2 Visual Communication

In the process of understanding visual communication across communities of practice, one question that arose was whether images were used as boundary objects or boundary negotiating artifacts. The term boundary object originates from work by Leigh Star (Star, 1989) and is further clarified by Etienne Wenger (Wenger, 1998). By their definitions, boundary objects, “serve to coordinate the perspectives of various constituencies for some purpose (Wenger, 1998, p. 106).” More recent work by Lee (2007) created the distinction between boundary objects and boundary negotiating

artifacts. Within this new distinction, boundary objects pass, “from one community of practice to another with little or no explanation (p. 312-313),” while boundary negotiating artifacts do not communicate information independent of a negotiating process. When coded from this distinction, all images used within all three case studies were boundary negotiating artifacts.

Lee notes that boundary negotiating artifacts are possible predecessors of boundary objects (p. 334). The case studies conducted here ended at opening night and did not look at the information crossing between the theatrical community of practice and the audience; however, the final costume resulting from the design process would communicate between those communities of practice with no additional negotiation.

Within the context of boundary negotiating artifacts, this research then attempted to understand image use within the communication process. Marsh and White (2003) present the most comprehensive taxonomy on image use available. The original taxonomy codes how images are used in conjunction with text and needed to be adapted to apply to visual communication. The original taxonomy contained three categories based on the relation of image to text. Within the context of the case study and conversation/negotiation, this distinction was less observable and less relevant. The researcher first condensed the taxonomy by removing the text-to-image relationships. Second, the researcher consolidated the resulting list to a single level. When a top level code was superseded by a lower level code, the researcher removed the higher level to reduce redundancy and increase specificity. Also, when the lower levels were too granular to be applicable to the data, the researcher consolidated these into the higher

level. The original taxonomy and changes made are presented in **Appendix 2: Changes to Marsh and White Taxonomy** .

The researcher then grouped the codes by how the code implied the image acted within the conversation:

- Image affects Negotiation
- Image suggests Information
- Image represents Information
- Image affects Viewer
- Negotiation affects Image

Within this level, the term “negotiation” indicates verbal or physical interaction using the images as a boundary negotiating artifact. The term “image” refers to an individual or group of images, videos, or visual elements.

Finally, the researcher conducted preliminary coding of the data to test the taxonomy. Based on data, the researcher further refined the definitions and added one new category, Refine. This category likely did not occur in the text-centered taxonomy because it directly relates to communication processes. The final coding scheme, along with examples from the data, is presented in Table 9.

The two codes, Condense and Refine (Negotiation Affects Image) directly correlate with the codes Elimination and Alteration due to Negotiation Process in Section 4.2.2.2. These were the only two types of changes that resulted from the negotiation process. The codes that might correlate to Format Change and Re-conceptualization do not occur in this coding. Because the correlation is exact, these codes are not discussed again within this section.

Table 9: Image Use Codes and Examples

Term	Revised Definition	Data Examples
Image affects Negotiation		
Motivate	Image is used to initiate a negotiation.	CS2: The participants discussed wigs during a production meeting. The director had recently seen a show at another theatre which used wigs built of alternate materials. They pulled up those images on a laptop in the production meeting to initiate a discussion of ideas for the wigs.
Change pace	Image is used to shift an existing negotiation to a new topic.	Not Used
Reiterate	Image is used to restate a previous event within the negotiation with minimal change in order to clarify or record.	CS2: The costume designer brought images to ask, "Is this really where you're going?" CS3: The director recorded and posted rehearsal footage so the ensemble could see the final outcome of the design process for any given day.
Image suggests Information		
Decorate	Image is included to make an image more attractive with no further purpose.	Not Used
Contain	Image is used to suggest limits.	Not Used
Locate	Image is used to suggest time or place.	CS1: During the initial meeting with the director, the costume designer stated, "I showed her a couple pictures out of a book that I had to see if we were on the same page about time period."
Induce perspective	Image is used to suggest relative importance.	Not Used
Compare	Image is used to suggest a similarity or relationship.	Not Used
Contrast	Image is used to suggest a difference or separation.	CS1: The designer selected, "a painting vs. an etching to show...the difference between the two categories [upper class/lower class]."
Image represents Information		
Explain	Image is used to represent complex ideas or concepts.	CS2: The lighting designer used lighting swatches to show how the light would affect the costumes. "It's not this but along these lines. It may tint your costumes, but not much."
Document	Image is used to represent factual information.	CS3: Numerous insect images were used to show what bugs look like.
Model cognitive process	Image is used to represent an abstract process.	Not Used
Model physical process	Image is used to represent a material or mechanical process.	CS2: The hairstylist used a YouTube video to learn how to style the hair.

Term	Revised Definition	Data Examples
Graph	Image is used to represent numeric information.	Not Used
Image affects Viewer		
Elicit emotion	Image is used to evoke an emotional quality, effect, or response.	CS3: The director presented a “teaser” to gauge the ensemble’s reaction.
Express poetically	Image is used to evoke a spiritual quality, effect or response.	Not Used
Engage	Image is used to draw and/or hold the viewers’ attention.	Not Used
Negotiation affects Image		
Condense	Image leads to reduce a set or to reduce a larger representation to essential elements.	CS3: The costume designer/director created various prototypes, “to choose from which one worked best.”
Refine	Image leads to changes to the image.	CS3: The puppet designer created a version of the puppet early to discover what changes would be needed.

Of the coding schemes used in the dissertation, this was the one most strongly based in previous research. It is also the most detailed. After two iterations of coding, the correlation between the two coders using the sub categories was 73% but the correlation between the top level categories was 87%. Often differences were subtle in the lower level but much more obvious in the top level categories. Because the correlation was stronger, the results are reported out at the higher categories with information about what subcategories occurred rather than counts. The coding scheme likely needs refinement using future research.

Figure 21 presents a breakdown of how images were used in communication processes in each case study.

Figure 22 shows image use by design stage across all the case studies. In all three case studies, images were most commonly used to present information. This occurred primarily when the participants were researching and understanding the play and decreased as designs were created and costumes were finalized.

Figure 21: Image Use by Case Study

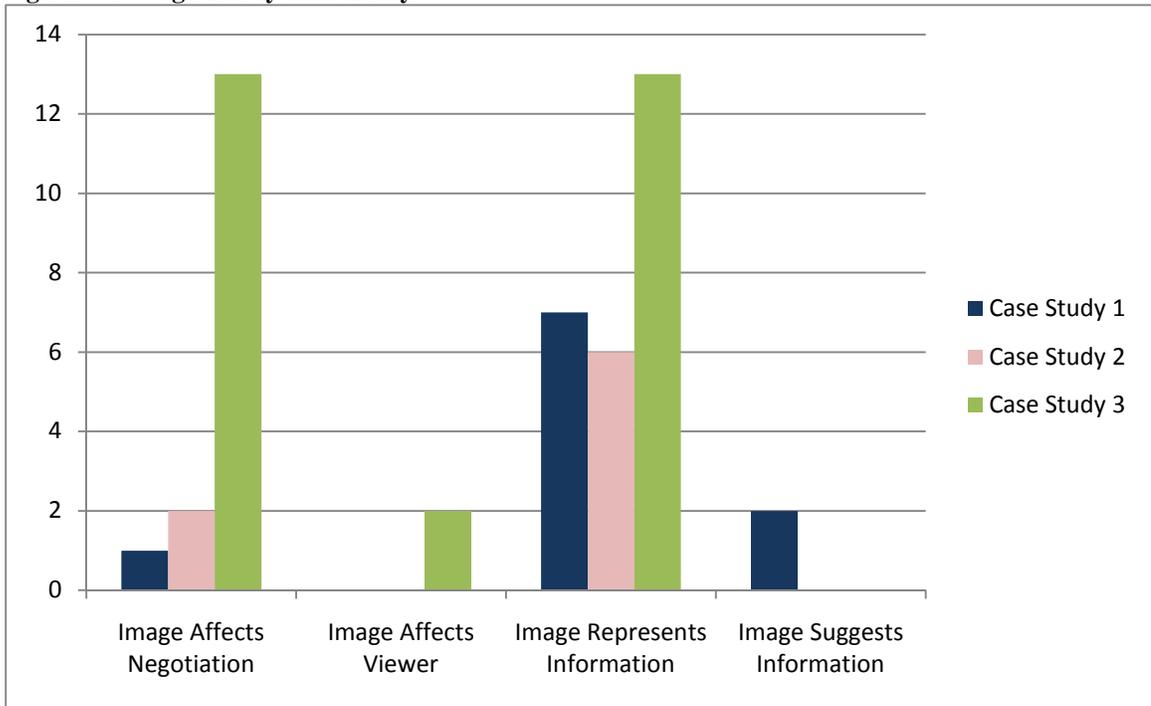
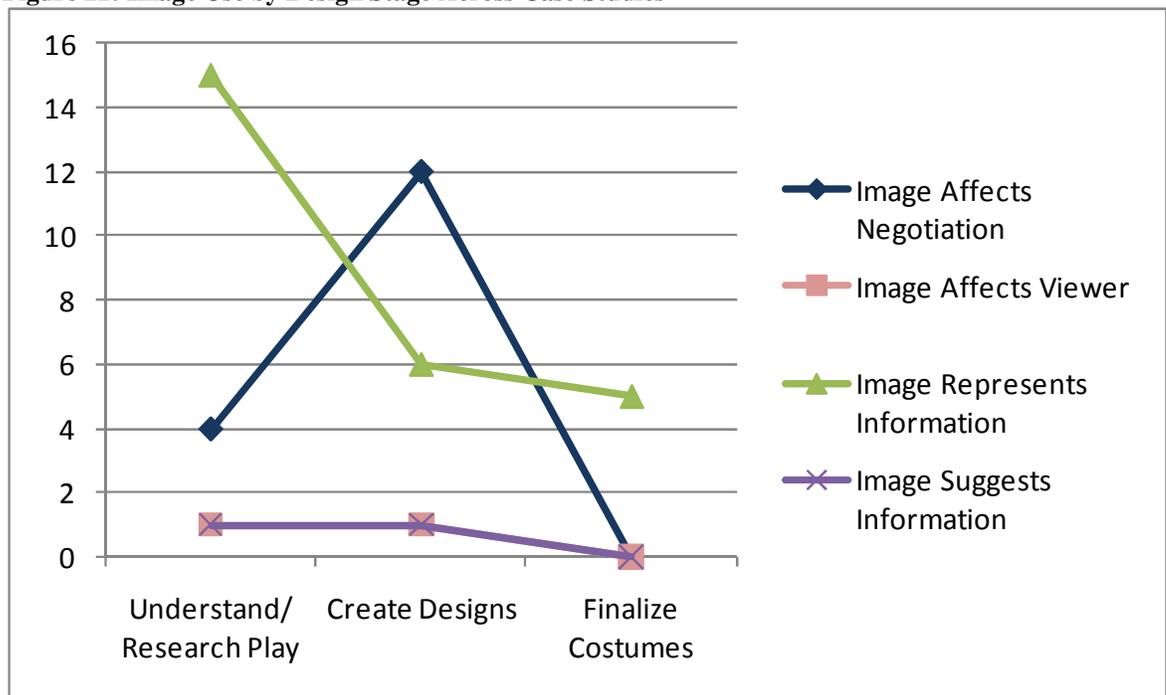


Figure 22: Image Use by Design Stage Across Case Studies



Within this category, images were used to Document, Explain, and Model Physical Processes. Case Study 3 made the heaviest use of images to Model Physical Processes, all of which were during the first design phase. This was primarily because of Case Study 3 participants' use of videos to demonstrate insect movement. The other two case studies used significantly fewer images to Model Physical Processes, but these always occurred at the end of the production when images were used to explain how to build a costume. Images were used to Document and Explain throughout the design process in all three studies.

The second most common use for images was to affect negotiations. In the third case study, which was more collaborative by nature, image use to affect negotiation was as common as image use to represent information. Within this category, images were used primarily to Reiterate and primarily in the third case study when videos of rehearsals were created and shared to capture and present what occurred to all participants. Images were also used to Motivate and Change Pace, but less frequently.

4.3.3 Visual Elements and Information Conveyed

During the final interview, each participant who created images within each case study was asked to discuss the images they created. Photographs were brought to these interviews as prompts. Their descriptions, along with any discussion that centered on images during the design process, were coded by the type of visual element referred to and the information the visual element was intended to convey.

Eleven visual elements were coded for Case Study 1, 18 for Case Study 2 and 6 for Case Study 3. The visual elements coded were:

- **Color:** References to the shade, shadowing, intensity, or hue of an image or part of an image.
- **Coverage:** References to the amount of area covered or not covered by a part of an image. This was typically in reference to the amount of skin exposed by a costume piece.
- **Pattern/Texture/Decoration:** References to patterns, textures, and decorations within an image. If reference was to an overall outline of a garment, Shape was used.
- **Shape:** References to a shape, including lines, within an image. These typically refer to the silhouette of a costume or part of a costume.
- **Perspective:** References to the angle or view from which an image is created.

The coding scheme evolved from the data, but can be applied to computer-supported visual search mechanisms such as search by color composition or shape.

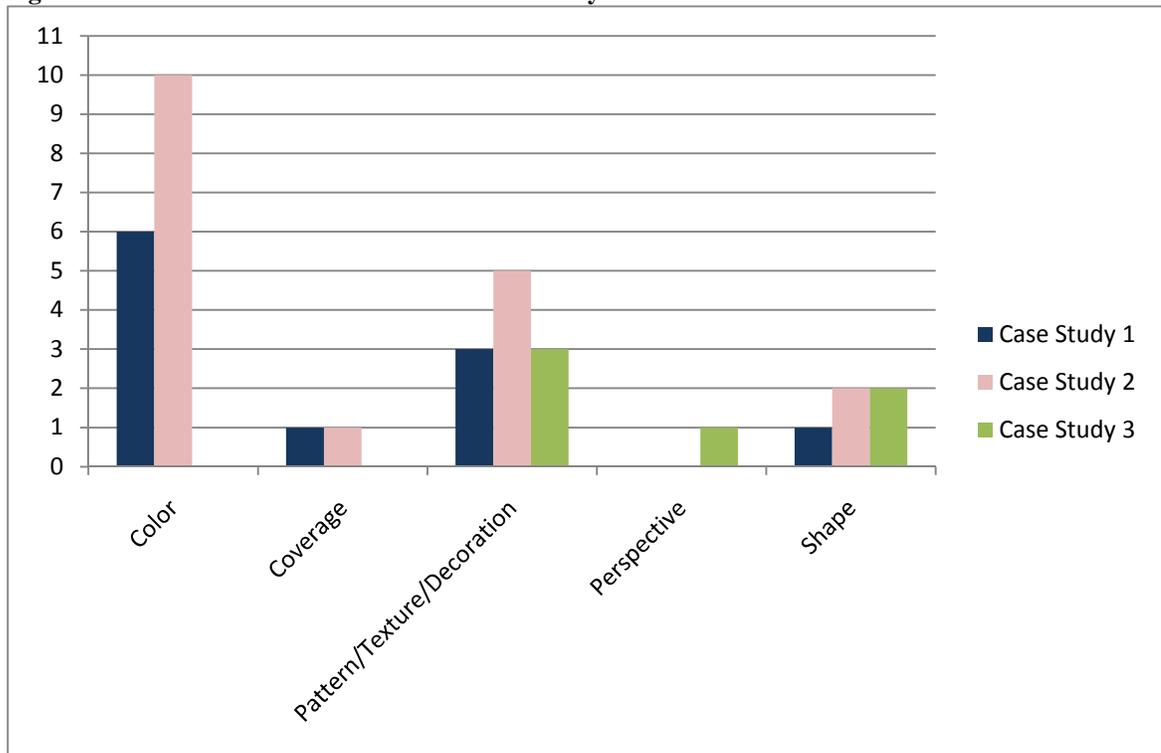
The Types of information coded were:

- **Character Description:** Factual information about the character such as age, social status, job, or species. Include character's fiscal, temporal, or social evolutions.
- **Character Personality:** Information about the personality of the character, such as the character's temperament or shyness. Include character's emotional evolution.
- **Relationship Between Characters Exists (code used – Relationship Exists):** Information that indicates that two or more characters are related in some way.

This can be showing similarity or differentiation between groups. It should not indicate the relationship of a character to the setting.

- **Quality of a Character Relationship (code used – Quality of Relationship):** Information about the type of relationship between characters that goes beyond the association. For example, a relationship may be antagonistic or loving. If this is used, more often than not the Relationship Between Characters Exists code should also be used.
- **Setting:** Information about the time period or location of the play.
- **Movement:** Information about movement of an element within the image.

Figure 23: Visual Elements Used in Each Case Study

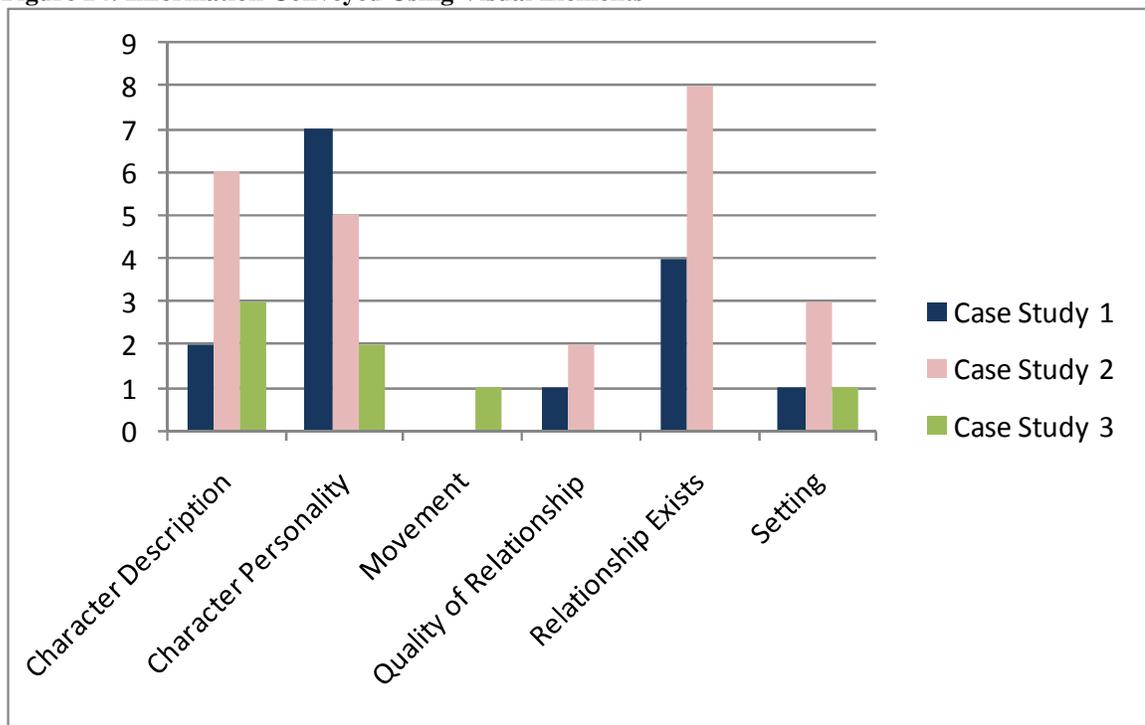


As illustrated in Figure 23 (above), the designer in the first two case studies used color to code the majority of the information she was trying to convey while the designer in the third case study did not discuss using color as an encoding device at all. Both

designers used Pattern/Texture/Decoration and Shape to convey information in all three plays. The similar pattern of use of visual elements to encode information between the first two productions, when compared with the third, may indicate that the reliance on various visual elements as encoding devices varies based on the individual designer's style and approach. The third production was modern and abstract so this too may have factored into how visual elements were used. Further research is needed to determine what role individual designer preference plays in encoding visual information during costume design practice.

Figure 24 (below), presents the types of information the designers intended to convey using various visual elements. Information about individual characters accounts for roughly 50% of the information intentionally encoded in all three case studies.

Figure 24: Information Conveyed Using Visual Elements



One of the study's goals was to explore any differences in visual search and selection techniques due to the image's intended use as a medium to communicate affective and

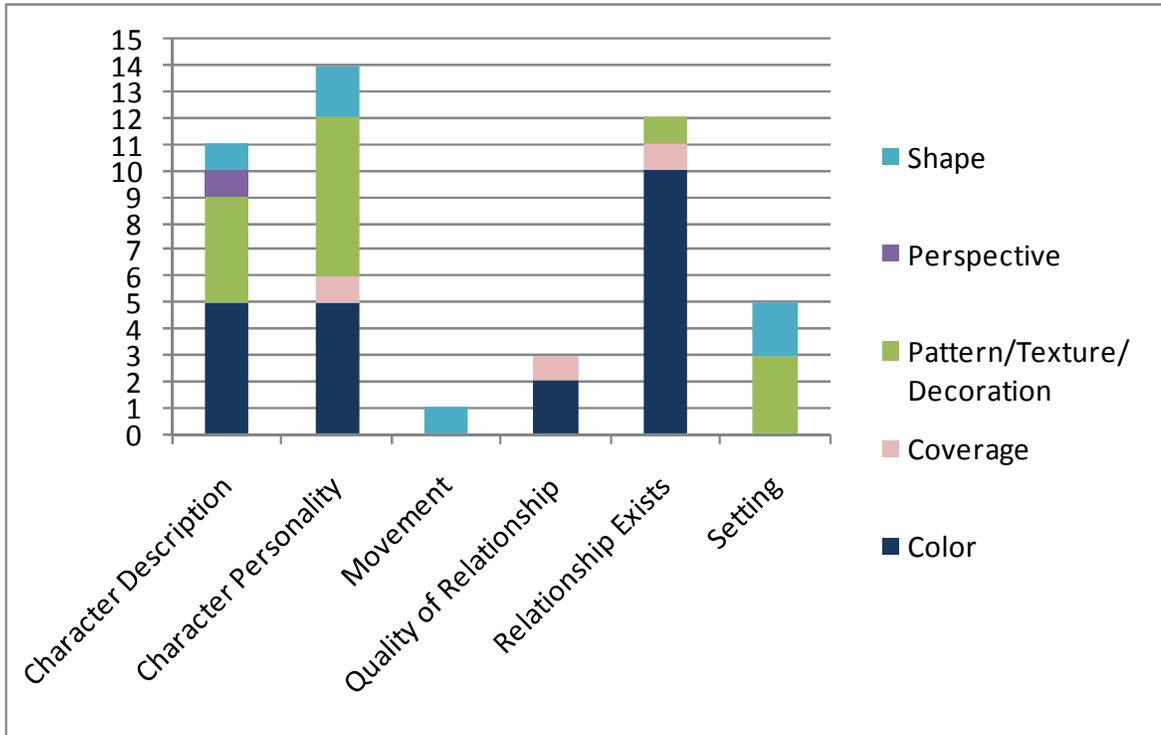
cognitive information. This distinction was not clearly articulated or distinguished when participants searched for and selected images, but designers attempted to communicate both types of information when creating final costumes. Working with the codes above, Character Description, Relationship between Characters Exists, Setting, and Movement all represent factual, cognitive information while Character Personality and the Quality of a Character Relationship represent more subjective, affective information. Based on this division, the following percentages of information designers discussed intentionally trying to convey was affective:

- Case Study One: 53%
- Case Study Two: 29%
- Case Study Three: 29%

Since affective information plays a role in image use as a communication tool, further research is needed to understand how affective information affects visual search and selection.

Figure 25 illustrates that various visual elements are used to convey each type of information although setting is shown using only Shape and Pattern/Texture/Decoration. This might indicate that shape recognition which could identify clothing silhouettes or motifs in fabrics could be used to expand on time period searches.

Figure 25: Use of Visual Elements to Convey Information Across Case Studies



4.3.4 Use of Gesture and Body Movement

The use of gesture and body movement in visual communication and the design process became apparent during the second case study. Since the first case study centered on the designer and did not include observations, there was no opportunity to note the use of gesture or body movement. Gesture and body movement was used in two ways in the second and third case studies.

First, participants used body movement to reiterate, develop and/or detail visual communication. For example, in the second case study, the costume designer and two actresses were discussing hair. While looking at portraits, one actress stated, “The front would be up with volume and the back could be down and curled.” She demonstrated using her hair. The costume designer flipped pages to a new portrait. “She looks younger...” The actress demonstrated the new hairstyle, “She has it pulled up like this.”

The design process for the third case study used an exploratory methodology called “View Pointing” which specifically uses images to guide exploration. The director described this as, “When working on a section of a piece, if an image I have [relates], I describe what I like and we play. Sometimes, we see if we can create that image. A lot of discoveries and unique things come out of the group.”

Second, participants pointed to indicate a specific aspect of an image or a specific point within a video. Two examples from Case Study 2 follow:

- **Costume Designer and Producer:** During a joint search for wigs, the costume designer and producer scrolled through a commercial site and compared prices. While looking, the producer pointed to an image and said, “That’s a little long.” Later in the search the producer asked, “What does [the director] want? More like these guys?” and pointed at images displayed on the computer screen. The costume designer pulled out images she’d printed, and said, “More like this.”
- **Costume Designer and Mask Builder:** When the costume designer was explaining how to put together a mask she pointed at a rendering, and stated, “If you need to build up to that, you can build up to those too.” Both the designer and the mask builder used their fingers to trace on the image. The designer explained, “...Do that but on both sides...Go by this [drawing] but if it isn’t going to work, play with this [mask and supplies] and change it [final product]. This can go around the edge; possible the eyes.”

In Case Study 3, much of the visual communication occurred on an electronic forum and text was used to substitute for pointing as an indicator of a specific portion of an image. Examples include:

- “...it was the image at the beginning of the fabric being pulled over...”
- “The first video is just amazing.”
- “...it’s a bit cut off at the beginning and end.”
- “...she starts around :30...Starts the beatboxing around minute 3:00...”

4.3.5 Summary: Images Communication and Collaboration

In the first two case studies, the majority of visual communication events occurred between individuals, particularly the designer and director. Within the third case study, the majority of the communication occurred between an individual and the larger community of practice. This was likely due to the collaborative nature of the production and use of an online forum as well as the fact that the costume designer and director were the same individual.

In all three case studies, images acted as boundary negotiating artifacts, communicating information within a negotiation process. Within this larger context, images acted in one of the following ways in relation to communication across communities of practice:

- The image affected the negotiation process.
- The image suggested information.
- The image represented information.
- The image affected the viewer.
- The negotiation affected the image.

The primary use in all three case studies was to represent information, with the secondary use being to affect the negotiation process.

Participants intentionally used specific visual elements within images such as color, coverage, line, pattern/texture, complexity, and shape to convey information about characters, setting, relationships, and movement. In addition, gesture was used to reiterate, develop and/or detail visual communication as well as to indicate specific portions of an image.

4.4 *Image Search and Selection*

This section addresses the following foreshadowing questions:

- What resources do costume designers use? (4.4.1)
- How do costume designers select and organize images? (4.4.2)
- How do search and selection strategies change as the costume design process evolves? (4.4.3)
- What, if any, are the variations in the search and selection process based on the intended image use? (4.4.3)

Table 7 (Repeated): Summary of Case Study Variables

	Case Study 1 (Pilot)	Case Study 2	Case Study 3
Time Period	Past	Past	Contemporary
Originality	Frequently Performed	Frequently Performed	Original Work
Abstraction	Realistic	Realistic w/ Fantasy Elements	Abstract w/ Fantasy Elements
Costuming Strategy	Most built, some existing	Most existing, some built	Equal amount exiting and built
Budget/Character	\$24	\$190.00	\$83.00
Time Frame	8 weeks	8 weeks	12 weeks
Designer	Designer 1		Designer 2
Theatre Type	Children’s Theatre	College Theatre	Professional Ensemble

4.4.1 Resources Used

Table 14 presents the resources used by case study. The resources used fell into five categories: online resources, videos, written/verbal resources, institutions, and personal resources.

Online resources were used most frequently, possibly for reasons of availability.

The costume designer/director from Case Study 3 stated:

It kind of depends on the project about how I approach it and where I sort of go look for images. And because of my schedule... a lot of times I can't go to places; like go to a museum. I rely on the Internet and thank goodness that there is so much out there.

In particular, **Google** and **Google Images** were used in every study.

Both online and offline videos were used in the second and third case studies.

The online videos were from **YouTube** or **MetaCafe**. For the second case study, the designer watched the movie version of **Amadeus** and the director watched **Marie Antoinette** and **Bram Stoker's Dracula**. In the third case study, the ensemble watched a documentary about insects and also generated and shared video of the rehearsal process.

Table 10: Resources Used in Each Case Study

Resource	Case Study 1	Case Study 2	Case Study 3
Online Resources	Yes	Yes	Yes
Google Images	Yes	Yes	Yes
Google	Yes	Yes	Yes
YouTube	No	Yes	Yes
MetaCafe	No	No	Yes
Google Video	No	No	Yes
Videos (Not online)	Yes	Yes	Yes
Videos of previous or related productions	No	Yes	No
Documentary	No	No	Yes
Self Generated Videos	No	No	Yes
Written/Verbal Resources	Yes	Yes	Yes
Script	Yes	Yes	No
Interviews	No	No	Yes
Institutions	No	Yes	No
Library	No	Yes	No
Other Theatres	Yes	Yes	No
Personal Resources	Yes	Yes	Yes
Previous Experience	Yes	Yes	Yes
Personal Collections	Yes	Yes	No
Everyday Life	No	No	Yes

Written and verbal resources were used in each production’s design process. The first two case studies included frequent references to the script. The costume designer in the first two case studies took detailed notes based on the script and referenced them throughout the design process. This is illustrated in the following scenario, which occurred during a production meeting:

Costume Designer: “Is she supposed to have two pregnancy looks? 6 months and 9 months or just the 9 months? Or should she just be pregnant for the birth?”

Director: [Flips through the script] “...I have not really thought about how much time that is. I think we could say she’s newly pregnant at that portion.”

Costume Designer: “So don’t worry about it at that point?”

Director: “Do you know where it is in the script?”

Stage Manager: “I think its page 71? Mid 70s somewhere.”

Director: “I can’t find where the Venticelli say, ‘And the baby on the way...’ That’s what I’m looking for....”

Costume Designer: “I think it’s before the scene where she says, “I’m cold. I’m cold.[Entire group flips through the script] I put in my plot p. 68 pregnant and page 72, very pregnant.”

In the third case study, interviews were conducted to better understand and develop the production as a whole. These were then referenced during future communications.

Institutional resources outside of the existing theatre were used in the first two case studies. The costume designer and director in the second case study used a library to find images and the costume designer pulled costumes from other theatres for the first and second case studies.

All three case studies used personal resources in the form of previous experience, personal collections, and everyday life. Previous experience was referenced to contribute to design discussions. For example, when discussing hair styles for the second case study, the director asked, “Do we have any rats to put this over? You could probably do that [referencing a portrait] pretty easy with one from here to here...I made a couple [rats] with stockings. You have to work with them every night...”

The designers and directors in the first two case studies discussed long term activities of creating and referencing personal collections. Examples include:

- **Case Study 1, Costume Designer:** "I try to amass books that I think are relevant to what I do."
- **Case Study 2, Costume Designer:** [During web search] “I bookmark interesting pages.”
- **Case Study 2, Director:** “When I went to the Louvre this summer, I just took photo after photo of the hair on the back of the statues.”

These collections include books, digital photographs, websites, and objects. They are collected during non-design related activities such as the visit to the Louvre and theatre related activities such as production meetings. In Case Study 2, The costume designer had brought a book illustrating hair styles from various time periods to a production meeting with the director, stage manager, producer, lighting designer, and props manager. During the meeting the following conversation occurred:

Director: Can I see your hair book?

Costume Designer, as she passed the book: This is crazy hair but I have paintings that are more realistic.

Director: Look at the hair with boats.

Stage Manager: And fake birds

Director, as she held up the book: Is this their real hair showing?

Costume Designer: No I think that's the wig but that's their real hair. Because of the wigs they kept their hair short....When I found this book in the store, I had to have it.

Director: It's the greatest book ever.

Costume Designer: It's been incredibly helpful over the years.

Director: I'm going to look this up on Amazon and order it. We just did a Chinese play and had to do all the research on hair.

This conversation illustrates how both previous experience and collecting resources contribute to the design process over multiple, unrelated productions.

Similar to long term collecting, the third case study used observation of everyday life to contribute to the design process. This is, to some extent, a short term collection

process that applies to a single production rather than a long term activity. The original design idea for the production in Case Study 3 evolved from the director/costume designer “listening to insects talking.” She continued to use "awareness when outside” to develop her designs. When discussing her research process, an actress stated, “I kept looking around in my world. Stuff in my house. Leaves on a tree... I go through stuff...I have a lot of things. So trying to find something that was...kind of unknown to me.”

As part of the final interview, the designers were asked how the costume design process used during the case study varied from that of other productions on which they had worked. As part of their answer they both discussed resources they used on other types of productions. Additional resources they mentioned were: fashion magazines and other magazines, television shows and documentaries, theatre books illustrating other designers’ work, and music.

4.4.2 Image Selection and Organization

Three aspects of image selection and organization relating to system design stood out across the case studies:

1. Image comparison,
2. Set building, and
3. Associated text and tagging of images.

Each aspect is discussed in detail below.

4.4.2.1 Role of Image Comparison

The motivation behind comparing images varies, but regardless of the format the image takes or the use of the image, the ability to compare multiple images as easily as possible was critical to image selection and refinement in all three case studies. The

designer in the first case study was observed opening three or more books at a time and flipping back and forth among pages before selecting an image. When asked about it in the final interview, she described her thought process as:

Sometimes I would open books and look at them depending on the character... I don't even really know how to describe this beyond just being artistic. Like what was an image that would work for Kate? So I might be looking back and forth between them going: 'Oh yeah I could see this is her or no *this* is her.' And it may be very different ideas of who Kate could be ... That is one possibility. The other thing is if I just saw something and was like, oh that's great, that's wonderful, who could that be? ...Approaching it from a different way, [asking] how can I incorporate this into the show because I'd really like to have this look up there. Who could it work for? And then again, sometimes it's like, if this is Kate, could this one be Bianca? Is it an opposite enough one. So there are different ways of why I would be comparing them.

In the second case study, the designer used a similar process when selecting costumes and purchasing wigs, but additional criteria such as price and size came into play.

In the third case study, the costume designer/director compared multiple images along with the emerging set to make final design decisions.

I went back to the images when I was working on the web because at first we had talked about... these spokes coming out of the center column. Do we need something that attaches to the ceiling so it really looks like a web? Do I need it to look that literal like a web but since we have... the huge spider web overhead...

so I always went back to the image book when I was working on ... some of the pieces that we had to do.

Image comparisons of multiple images played an important role in both designers' work.

4.4.2.2 Role of Set Building

Both designers in all three case studies created sets of images for their work. In the first case study, the designer printed and photocopied images as she found them and created collages for each character or set of characters (See Figure 26). The process of creating the final groups included a process of grouping and regrouping. The designer described the process, "I start to categorize them between the different groups... Trying to find all the images I like of everything, and then trying to pare that down or group that up, and then weed out ones that I might realize aren't as good as other ones I have."

Figure 26: Example of Collage from Case Study 1



In the second case study, the designer created sets of costumes organized in the same manner. The designer also printed out a group of mask images for the director to review. The director removed several images which led to a smaller subset of images the designer used when creating her preliminary designs.

The costume designer/director in Case Study 3 created an image book for use throughout the production, “I gather my own images for my book and present my book [to the actors]. It’s available at all times.” The director in Case Study 2 did not create an image book, but discussed her typical process which includes an image book, “I was not doing normal research for my actors... Usually I have an image book. I usually collect every image I can, but I didn’t for this play because I was doing research at the library and my home printer was not working. Usually I have an image book at every rehearsal.”

The actresses in Case Study 3 also created collages. “The [Director] [told us to] think about symbol[s] ...and object[s] of particular interest to [symbolize] domestic violence or insects. Then put the collection into a collage [with] the name of the symbol and significance of it.” The results were shared with the ensemble. In all of these examples, the creation of groups of images was part of an internal or external negotiation process. The groups themselves were part of the communication.

4.4.2.3 Role of Associated Text and Tagging

While this study set out to study images, the importance of text in relation to images became apparent in the pilot study and continued throughout the other two case studies. The study set out to understand image search and selection independent of a single system to allow for the widest range of search. All search instances in all three

studies was conducted using text. This is likely due to the lack of methods to search imagery beyond browsing. In addition to text's role as the means of locating potentially interesting images, text also plays a role in image selection and also supplements the information images can provide.

While searching, the costume designer in Case Study 1 pointed out,

Some of the books I [own], have a lot of text in them and very few pictures. And the text can just be telling me what colors were the colors of the time period or the necklines and sometimes it gives me information that you can't quite get from an image. But it just all kind of makes everything go together better if you have the written statement of [how or whether] they wore the petticoats so that no one could see their ankles.

During search sessions in both Case Studies 1 and 2, text descriptions were referenced before making selections.

Text and images complement each other. During a joint online search session for masks in Case Study 2, the following exchange occurred:

Producer: [Looked at text description.]

Costume Designer: They say unpainted paper mache.

Producer: But they don't give pictures...we want to see a picture.

Costume Designer: Yup [Read description].

Producer: Give us a picture...bastards.

Costume Designer: Maybe that's why they are wholesalers.

The site was then abandoned.

In addition to utilizing existing associated text, the designer in Case Studies 1 and 2 also tagged her images. The tagging served as part of the set building process and was not observed in Case Study 3, so this may be a personal strategy. The labels used are

listed in Table 11. Labeling the images facilitated finding them later by both the designer and the director.

Table 11: Image Tagging

Case Study	Tag Type	# of Tags	Example
1	Character Names	12	Kate
	Groups of Characters	5	Serving women
	Articles of dress	3	Slashed sleeves
	Characters modified by articles of dress	3	Columbine (w/high collar)
	Other	1	Silhouette
	[Tag with No Text]	2	
2	[Tag with No Text]	18	
	Actors' Names	17	John Smith
	Groups of Characters	1	Venticelli

4.4.3 Variations in Image Search and Selection Strategies

This study set out to understand how search and selection strategies varied as the costume design process evolved and whether intended image use led to changes in the search and selection strategy. The differences in approach between the three case studies, and particularly the ambiguity embraced as part of the third case study made clearly identifying stages impossible. The data was analyzed based on the sequence of events rather than the costume design stage. Two general search/selection strategies were used and are described below. They did not vary based on timeline. An additional strategy supplementing the first two was used rarely, but is worth noting for system designers.

Previous research has found that browsing plays a central role in image search and selection. This was true for participants in this study as well. Marchionini (1995) expanded on definitions by Herner (1970) by defining three types of browsing:

- Directed browsing which is systematic, focused, and driven by a specific object or target. An example is scanning a list for a known item.
- Semi-directed browsing which is predictive or generally purposeful. The target is less definite and browsing is less systematic. An example is entering a single, general term into a database and casually examining the retrieved records.
- Undirected browsing which is when there is no real goal and very little focus. Examples include flipping through a magazine and "channel-surfing." (pg. 106)

These three types of browsing were used when analyzing the search behavior in each case study.

4.4.3.1 Strategy 1: Create a Set and Use Comprehensive, Directed Browsing

The search strategy used in the first two case studies consisted of:

1. Creating an initial set of images based primarily on time period,
2. Selecting an initial set of images through browsing, and
3. Comparing images to make final selections.

This strategy remained consistent in both virtual and physical media, for all observed participants, and for images as well as video.

Several examples of this strategy are below.

- **Case Study 1, Costume Designer** (Initial search, to “refamiliarize [her]self with the time period.”): She searched **Google Images** with “1592 England.” She viewed in detail every link on 4 pages of results, expanding thumbnails, watching videos, bookmarking interesting pages, and printing relevant images.

- **Case Study 2, Director** (Initial search, “to prepare for initial production meetings”): “I immerse myself. I go to the library and spend a couple hours a day... I was looking for time period. I did a lot of historical research, looking at palaces and paintings from the time period. Anything that had to do with aristocracy and palaces. Some research to photographs of furniture from the time period. A lot of Versailles. There is not a lot of the palace in Vienna.”
- **Case Study 2, Costume Designer** (Search through books to locate images of hairstyles): She looked up artists from the time period and then went to the library and pulled any books of paintings by those artists. She then browsed the entire contents of each book.

The only distinguishing feature in the strategy was when a group of images was needed for only a single final product, as in the case of purchasing an apron or locating a “how to” video. In the case of the first situation, time dictated when the end was reached and in the second, the end was reached when the final product was found.

Case Study 3 included references to searches that fit in Strategy 1, but because of logistics these searches were not observed so it is difficult to say whether the searchers browsed as comprehensively as the searchers in Case Studies 1 and 2 did or if s/he only looked at a few images. These searches were primarily for images of bugs. An example was the director’s search for examples of insect movement. The search was conducted using **Google Video** for all videos on “caterpillars crawling.” Two videos resulted that were shared with the group. When the search was mimicked by the researcher several weeks later, the videos were from the first page of search results.

4.4.3.2 Strategy 2: Semi-directed Awareness

The majority of searching in the third case study consisted of a semi-directed awareness in order to identify images, videos, objects, and text that symbolized or represented domestic violence. Searching and browsing online was used and varied in the amount of query refinement and browsing, but this was part of a larger strategy that exposed the participant to a wide variety of resources in order to fulfill the information need.

Several examples of this type of search are below.

- **Case Study 3, Director:** “I looked around and saw things. I searched for insects, cocoons, skin, emerging things....I used **Google Images** [and] **YouTube** too because I wanted some active images. [I looked for] insect’s world, movement dance pieces, music....insect sounds... searching, exploring the world.”
- **Case Study 3, Actress:** “I kept looking around in my world. .. trying to find something that was...kind of unknown to me. I found an onion.... online. ... The things around me didn’t stick. One day I was surfing online, on a graphics site...looking at a site that had images...hoping to find something I already had....While I was looking at something else I came across the onion.”
- **Case Study 3, Actress:** “I basically surfed the web. Found horrific stories about why abusers act the way they do...I found as much as I could find on why people stay....[I used] **Google** and typed in ‘domestic violence.’ I typed in a lot of *husband kills wife*. Basically **Google** was how I went.”

The case study methodology did not facilitate creating a clear link between image use and search strategy, primarily because search sessions in real life looked for multiple

images for multiple purposes at the same time. The primary difference between the two search strategies seems to be the exploratory nature of the design process within the third case study. In the first two case studies, the images were collected to represent information and concepts. In the third case study, the images were collected to provoke discussion and inspire new ideas. In terms of taxonomy of image use presented in Section 4.3, the images within the first two case studies were primarily used to suggest and represent information, whereas in the third case study the images were primarily used to affect negotiation. Further research in an experimental paradigm is needed to confirm if this is accurate.

4.4.3.3 Strategy 3: Query by Example

An additional search strategy was present in the second and third case studies that is worth noting for system design. As was previously stated, text search is the primary means of accessing image information at this time. One possible alternative is an image search where an image or image element is provided as the search parameter. While no searches attempted to use a system to do this, two searches showed evidence that it would have been desired.

First, in Case Study 2, the actress handling hair styles needed to locate information on how to mimic a hairstyle that the costume designer showed her. She took a cell phone photograph of the portrait and used it to help her search. She used **Google** and typed in *18th century hairstyles* to browse, but searching by inputting the photograph she took may have been a better alternative.

Second, in Case Study 3, an actress was searching for a specific insect she'd seen whose name she did not know. She described her search process, "I started Googling

what their legs looked like... One bug I found was long and had rainbow wings...I'd type [rainbow wings] in and never find the one I was looking for, but would find others." In both these instances the ability to locate images similar to a known image would have facilitated search.

4.4.4 Summary: Image Search and Selection

Participants used online resources, videos, written/verbal resources, institutions, and personal resources as sources for their images. Personal resources included previous experience, personal collections, and everyday life. Set building and comparing multiple images were key components of image selection in all three case studies. In addition, participants used related text to select and supplement images. The designer in Case Studies 1 and 2 tagged images, typically by character name, in order to organize found items.

Three search strategies were used. The first search strategy consisted of:

1. Creating an initial set of images based primarily on time period,
2. Selecting an initial set of images through browsing, and
3. Comparing images to make final selections.

The second strategy, used most often in the third case study, consisted of semi-directed awareness while browsing a variety of resources, often personal resources, until an image was found. The third strategy, querying by example, was used only twice; however, since search systems fail to support this strategy effectively at this time, its presence is worth noting.

The following chapter presents a model of image search, selection and use in costume design practice and then details requirements for a costume designer's workbench to support visual communication in costume design practice.

Chapter 5: Model and User Requirements

Overview

- Model
 - Guidelines
-

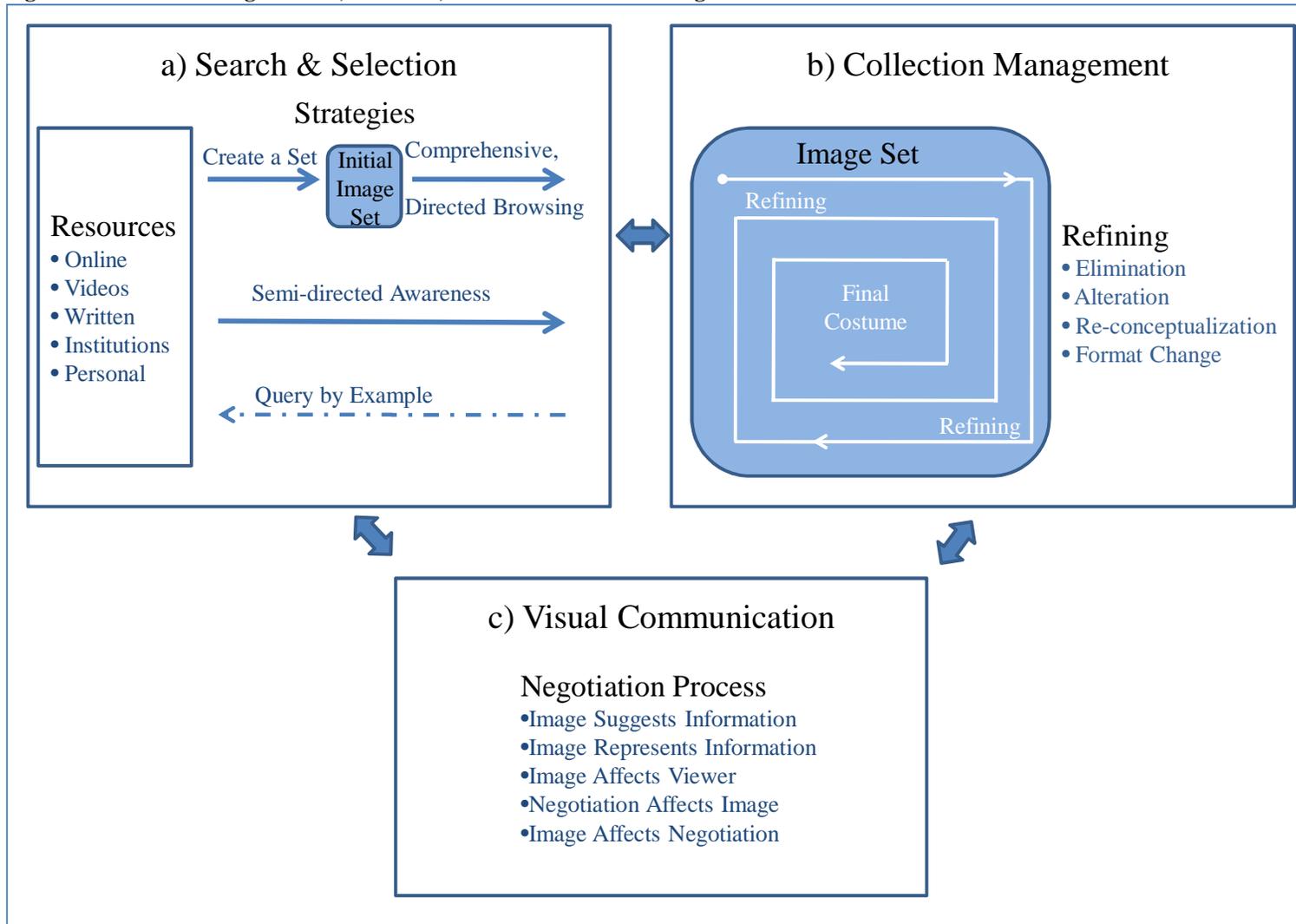
As mentioned in Chapter 1, over 184,000 performances are conducted by professional theatre companies in the United States alone, and this does not include community or college theatrical performances (Census Bureau, Table 1194). The goal of this study is to inform the design and development of digital systems to support costume designers. To that end, this chapter presents a model that summarizes the findings from the three case studies. The model is then discussed in detail and illustrated with examples from the case studies and previous research. Finally, the guidelines for a system to support costume designers are presented and discussed.

5.1 *Model*

While in many respects the detailed findings from the three case studies conducted in this research appear different, at a higher level, they inform a model that can underpin a socio-technical system to support costume designers. Figure 27 presents such a model of costume designers' search, selection and use of images based on findings from the three case studies. The model consists of three activities:

- a) Search and Selection,
- b) Collection Management, and
- c) Visual Communication.

Figure 27: Model of Image Search, Selection, and Use in Costume Design Practice



Participants transitioned between activities as they progressed through the costume design cycle. Movement between activities was not linear nor cyclical. Instead each visual concept was refined as a result of moving back and forth between stages as needed to turn the mental image into a physical reality. The process typically started with Search and Selection or Visual Communication and always ended in Collection Management with a final costume.

Participants searched for and selected images to create a new image collection or to supplement an existing image collection. These image collections typically centered on a character or group of characters. Participants then refined this collection of images in order to facilitate visual communication or as a result of visual communication.

Images resulting from the Search and Selection process moved into the Collection Management process. If, after comparing and evaluating an image set, participants felt they needed additional images, they would move back into search and selection. Some images used for a specific production might also be added to a personal collection which participants created and refined over the course of their career. Visual Communication among participants also initiated or reinitiated the Search and Selection process and further refined image collections.

In some cases, the Search and Selection process and Collection Management Process tightly intertwined with the Visual Communication process such that participants moved through all stages of the model in a matter of minutes. Details regarding what occurred within each activity are presented below.

5.1.1 Search and Selection

In Search and Selection, the model presents the resource types used by designers during the case studies, although a more diverse set of designers, or even the same designer on different shows, would use additional resource types. The resources used were quite diverse and confirm the wide variety of potential resources referenced in the costume textbooks. Although digital resources were used, analogue resources, including personal observation and collections as well as institutional collections, were key components of all three shows. Designers often printed or photocopied digital resources in order to create a single format of resources with which to work.

The participants observed used two general search and selection strategies. In the first strategy, they created a set of images and then conducted directed and often comprehensive browsing of the resulting set. Online, the set was typically created using a broad query such as “caterpillars crawling” or “1592 England” within an image-focused system such as **Google Image** or **Google Video** search. Offline, this was done by pulling all relevant books, videos, or objects from a personal and/or institutional collection. Designers browsed the entire contents of analogue sets. Several pages were browsed in online image results before a query was refined or another online source was used. The strategy of creating as comprehensive a set of images as possible was noted in Westman and Oittinen’s (2006) user study of journalism related image queries and Hertzum’s (2003) user study of requests to a film archive. Other studies; however, have found more frequent query refinement than was observed in this set of case studies.

While selecting images within a set, participants compared multiple images, often looking at three or more images at a time before selecting one or more for use. Markkula

and Sormunen (2000) also noted the use of comparison during selection. Participants also used associated text when selecting images and tagged and annotated images as part of the selection process. Participants then used the tags to form sets and of to quickly identify images of interest when discussing images with other participants.

The second strategy was much less directed. While searching and browsing were used, often awareness of the information needs during regular activities was more productive. Participants in the third case study used this strategy when looking for items to symbolize key concepts. Participants in the second case study used this to build personal collections. Online, participants queried and browsed results, but often found items when they were looking for something else. Offline, they, “looked around their world,” and again finds were serendipitous rather than the result of a directed search.

The third strategy represented in the model is Query by Example. This was used one time each in the second and third case studies. In this strategy, an image already located and identified as desirable was used to guide a search. Technology to use an existing image to search is not available in most popular web engines at this time, so the images were used as a reference rather than as a query.

5.1.2 Collection Management

Regardless of the search strategy used to gather images, image set building and refinement was central to the design process. The entire process of set building and refinement is guided by, and culminates in, a final costume that represents the participants’ mental image. Within the case studies, image sets changed because of the negotiation process; in order to better the presentation of ideas; for practical reasons such as time, availability, and skill; due to a miscommunication between parties involved in

the design and execution of a costume; in order to better fit the look and feel of the production; or to increase attractiveness. Regardless of the specific reason, image sets acted as a physical representation of the participants' collective vision and changed as that vision changed and became more concrete. This echoes Vyas et al. (2009) who found that, "the whole design practice progresses through the use and manipulation of these representations and through iterative refinements of both conceptual and physical designs of products being designed (p. 108)"

Before a particular production began, participants created and maintained personal collections of images that might be useful in the future. This more general set-building activity seemed to result from the second search strategy, where the participants remained aware of the larger information need while doing other activities such as visiting a museum while on vacation or building a specific show. The participants then used the resulting personal collections as one resource for building a more refined image set for a particular show.

Participants created a set of images for the particular show. Sub-sets of images might be created for each character or set of characters. Subsets and specific images might be tagged or commented upon. As the show progressed, specific images might be eliminated or altered to create a new image. The entire vision behind a set of images might be re-conceptualized leading to a new or a refined set of images. Images might also change format between digital and analogue or from a set of images into a single rendering capturing key concepts from the set.

5.1.3 Visual Communication

Images played a key part of the negotiation process between participants in the costume design process. Participants created image books, rendered drawings, provided images in email and an electronic forum, and brought up images and videos on computers in order to visually communicate their ideas face-to-face.

Images both affected and were affected by the negotiation process between participants. Participants presented images to initiate or change the pace of a discussion. During a discussion between participants, images were eliminated from sets or altered. Participants selected and created images to suggest information, such as the production's time period; represent information, such as how to create a certain hair style; or affect the viewer, such as presenting a video to gauge the reaction.

During visual communication, participants often gestured to portions of images. Within the electronic forum, participants described specific parts of video clips. When designing images, participants also used specific visual elements to convey certain information. The ability to specify and utilize some portion within an image facilitated visual communication. During face-to-face visual communication, participants also reiterated and developed visual communication using their body as an example.

5.2 Guidelines for a Costume Designer's Workbench

Image creation tools such as Photoshop already exist but all participants used analogue tools such as pencil, paper, paint, cloth, etc. to create images. This might change as younger individuals who grew up using computers move into professional fields or it may vary in better funded theatres. It is also possible that analogue objects and processes

may never be replaced by their digital counterparts for reasons of personal preference, ease of use, or resource limitations.

The costume designers workbench proposed below assumes that to be effective the costume designer will need to move between analogue and digital mediums throughout the process. When this transition occurs will vary based on the designer's preferences and resources as well as how, when, and where members of the design process are communicating.

The following guidelines are based on the findings presented in Chapter 4; however, they need further testing with other costume designers. These guidelines can then be used to develop a prototype of a costume designer's workbench for testing.

5.2.1 Support Collaboration and Negotiation

Costume Design contains both individual and collaborative processes (see Figure 3, Figure 4, and Figure 5) and a costume designer's workbench should support both types of activities. Both synchronous and asynchronous communication between one or more individuals should be supported within the same interface. The interface should be designed to support face-to-face interaction by providing a means to display current work. The interface needs to support one-on-one interactions between the director and costume designer as well as group interactions, such as production meetings, where several people may be present. The collaborative nature of the design process is critical, and all subsequent guidelines apply to individual and collaborative, asynchronous and synchronous, face- to-face and remote communications.

Because costume design images act as boundary negotiating artifacts, changes to the images provide an important record of the negotiation and communication process.

Images both affect and are affected by the negotiation process. A costume designer's workbench should capture and record a history of changes made and by whom. The ability to revert to a previous state should be available. Designers and other participants should also be able to annotate changes within the history.

A key part of face-to-face communication was the use of gesture and body movement (Section 4.3.4). A mechanism for indicating a specific portion of an image or video should be available. A costume designer's workbench should also facilitate the ability to supplement remote verbal or textual communication with actions such as demonstrating a hairstyle, perhaps by allowing video capture associated with an image, image group, or change history.

5.2.2 Support Collecting and Sharing

Costume design is a long-term social process. While each show can be viewed as an individual case, costume designers leverage the previous experiences of themselves and their colleagues (See Section 4.4.1). A costume designer's workbench should support a designer building an image collection over the period of their career. They should be able to easily capture, tag, and store images for the project on which they are currently working or for future projects. They should be able to easily locate the images in the future through search and browse capabilities.

Information sharing between designers and other members of the theatrical community should also be facilitated though not required. This can best be achieved by approaching the workbench as a socio-technical system that integrates a community of practice rather than standing alone as an individual application. A community-based system provides opportunities to improve collecting and sharing. For example, tagging,

note-taking, and associating media types already form a part of costume designers' work. If this is done in a community framework, then search engines can leverage associated text to identify relevant images and videos. Also, a community-based system could provide a platform for institutions to provide catalogues and links to costume inventories or fashion collections.

With this in mind, a costume designer's workbench needs to address copyright concerns for images imported into the system as well as support the ethics of the costume design community of practice. Any system designed to facilitate sharing also opens the risk of inappropriate sharing of copyrighted information or inappropriate use of another's work. Because a costume designer's workbench relies on external resources as a starting point, metadata regarding the source should be retained throughout an image's lifecycle. Designers should be able to input and supplement metadata, particularly on any items created. A metadata record allows future citing as well as future reference to the original source as needed.

During discussions, two participants mentioned their concerns about copying another's work during their interviews. One stated, "I don't want to copy someone else's work. I will draw some ideas from it, but use the trim from the store to redraw it for the students." Another stated, "I am concerned about copying people, so I flood my brain with tons and tons of images and walk away from it." The participants start by viewing others' work as a source of inspiration but consciously took steps to avoid copying anything directly. Copyright does not extend to fashion, however the participant's concern may portray a concern in the costume design community of practice. To

encourage and support sharing, clear regulations on these topics should also be included and enforced within the community portion of the system.

5.2.3 Facilitate Interaction With and Between Multiple Media Types

Costume Designers utilize a variety of resources including static images and text, video, and audio (See Table 10). These media types complement each other by providing various types of information. During search and selection, designers must be able to view multiple images, regardless of type, as well as any associated text or audio files. To support their work, costume designers must be able to create links between items regardless of the media type. A costume designer's workbench must find a logical way to "collage" multiple types of media and then display and interact with the results. Designers must be able to modify all types of files and transition between them seamlessly.

5.2.4 Assume a Part is as Important as the Whole

An image, text, video, or audio file may be important to a costume designer as a whole, but often only a part of the file is important. That part may be a specific area such as a hat within a drawing, a color within a photograph, a sentence or paragraph within a text description, or a short clip or freeze frame within a video. The part of the file that is important may vary based on the context in which it is used. For example, a hat in a photograph may be important for one character but the shoes might work for another character. Designers require the ability to isolate segments of any type of file, interact with it, and tag or annotate it.

5.2.5 Support Notes and Tags

Designers take notes about and tag images as part of their work (See Section 4.4.2.3) and a costume designer's workbench needs to support this. The same image may have multiple notes or tags depending on the context in which it is being used. As noted in the previous guideline, designers must be able to associate textual information with an entire image or with one or more parts of the image. To do this, a costume designer's workbench requires a notepad feature for easy input of personal comments and notes. They should then be able to search and create groups using this user-generated text.

5.2.6 Facilitate Mobile Capture and Presentation

Designers use images that may be available only in a single place such as a museum. Once they have captured an image in some manner, they then use it in a variety of locations; when purchasing items, pulling costumes, or meeting with other theatre staff. Because image capture and use must be conducted in a variety of locations, a costume designer's workbench needs to support mobility.

Many resources designers currently use are in analogue form. Participants in the case studies included interviews, personal book collections, institutional costume collections, and insects to name a few (See 4.4.1). To be effective, a costume designer's workbench must provide a mechanism to turn these resources into digital form. Images in digital form would support some design activities, such as allowing for easy image combination or a query by example search, but designers need a mobile mechanism to change analogue resources to digital. Mechanisms used in the case study included a handheld camcorder and a cell phone. A scanner for text resources would also be helpful though was not observed in the case studies.

The case study participants chose to turn digital findings to analogue form by printing items out in order to share them during face-to-face communications. Images in analogue format support mobility in places where a computer may be disruptive. They also provide a physical object with which to work. A digital system should support face-to-face communications as effectively as paper which may require a large screen. It must also provide the ability to create analogue forms quickly, at the time they are needed.

5.2.7 Facilitate Grouping and Regrouping

Creating and modifying groups was a key component of the costume design process (See Section 4.4.2.2).A costume designer's workbench must allow designers to create sets of images that include images found during searches, created using digital tools, or captured from an analogue form. Images or parts of images must be able to exist in multiple sets simultaneously. Changes to or removal of the image in one set must not affect the image in another set. In addition, multiple participants should be able to make changes to these groupings to support collaborative meetings. Since designers used character names to create sets in analogue forms, allowing them to title the set may facilitate tagging and, later, search and retrieval by other designers.

5.2.8 Facilitate Comparison

Comparing images must also be supported (See Section 4.4.2.1).When selecting images from search results, costume designers often compared multiple images before making a selection. When meeting, designers and directors compared alternatives. A costume designer's workbench should provide a mechanism for displaying multiple images on a larger screen or easily transitioning between images on a smaller screen. The system should also allow the designer to set aside images in a temporary queue

during search for future comparison or inclusion in the final result set. Allowing designers to annotate pairs of images may also support their work.

5.2.9 Support Search Using Existing Information

Because costume designers collect information that may be relevant to them over time, they often have images or text that can provide a starting point when conducting searches for a new production (See Sections 4.4.1 and 4.4.3.3). Although only two examples occurred in the case studies where images were used to guide search, existing search systems do not support this feature. When discussed with the costume designer during the member checks, she stated, “This would be so cool. That would be very helpful.” Later in the discussion, she pointed out that, “Sometimes I sketch something out and try to find research to go with it.”

A costume designer’s workbench should provide a mechanism for designers to identify an existing image or part of an image and use it to query. This system should also facilitate mining text documents to facilitate full text searching. For example, during the second case study the designer wanted paintings from the late 18th century so she located a list she had of all artists from that time period, then searched the library for books of their paintings. Query expansion mechanisms such as this could be built into the system and then designers could supplement them over time. The community in a socio-technical system could leverage this work that would occur naturally as part of the individual designers work process, to improve and refine image retrieval over time.

5.2.10 Facilitate Serendipitous Finds

In addition to directed searches, a costume designer’s workbench should provide support for serendipitous finds (See Section 4.4.3.2 5.2.10). These may be for long-term

collection purposes or for a current production. A recommendation system could provide images that might be of interest to a designer based on recent queries, images located in the temporary queue, or images located in more permanent groups. If the designer identifies the play s/he is working on, the system could push images that were useful to other designers working on this play. During the member check, the costume designer from the first two case studies pointed out that directors often specify non-traditional time periods or approaches to productions so additional filters would be needed beyond the play itself.

Some of the participants referenced looking at other versions of the same production for inspiration. Costume designers might choose to upload final renderings or photographs of their work for reference by other designers. Since a community system would be in place, rating systems or recommendations for resources could also be included to help push quality items to the top.

5.3 *Summary*

This chapter presents a model of image search, selection, and use within costume design practice and then presented 10 guidelines for designing a costume designer's workbench. During the member check, the designer from the first case study stated, "Overall it seems like it would be excellent to have all of that." These guidelines should be validated with other costume designers and a prototype created and tested. Chapter 6 summarizes the results and presents the limitations of this research. It then discusses directions for future research.

Chapter 6: Discussion, Limitations, and Future Work

Overview

- Discussion
 - Limitations
 - Future Research
-

This chapter presents a more detailed, overarching discussion of the findings and a synthesized vision of how the guidelines and model can be used to support each stage of the costume design process. It then addresses the limitations of the approach used and the studies conducted. Finally it presents areas for future research that build on the work conducted herein.

6.1 *Discussion of Findings*

6.1.1 The Costume Design Process within Theatre Production

Research to date on technological support for theatrical design has been limited. As discussed in the introduction, over 1,800 non-profit theatres and 3,522 theatre companies and dinner theatres operate in the United States. These numbers do not take into account the college and community theatres, operas, and ballets, which also require costumes. Theatres provide artistic value to a number of people and generate revenue for communities. In 2008, 11,787,738 people attended 1,587 Broadway shows for a total gross of \$894,676,023 (Broadway League, 2009). Broadway may be considered the pinnacle of live theatre, but it still represents only one portion of the overall effect of theatre in the United States and the world. Costume design for film was not studied in this research, but future research should test if the findings can be transferred to this area. If the findings are transferable, the effects of this research are even greater. The film

industry contributes 80 billion dollars to the US economy each year (Motion Picture Association, 2009). Theatrical designers present a large community within an important artistic industry that has not received significant recognition and research within the information studies and human computer interaction communities.

The approaches to costume design used by the participants in the studies varied, seemingly based on variables associated with the theatre and production rather than solely based on the designer's approach. The effect of the particulars of a production on the costume design process over individual designer's preference is supported by the differences in the design process between the first two case studies despite having the same designer. The costume designer in the third case study also stated, "It kind of depends on the project about how I approach it and where I sort of go look for images."

Like other design processes (Lawson, 2005), the costume design process is not sequential or orderly, rather it is composed of a series of iterative sub-processes which are repeated as needed until the final product, the costume, is satisfactory or until opening night, when time runs out. Within this process, the three stages listed below were distinguishable, although they did not necessarily follow each other in a sequential manner:

- 1) **Understand and research the play:** The costume designers read the play; conduct research into the time period, clothing practices and tone of the production; and meet with the director and often other designers.
- 2) **Create designs:** The costume designers create and refine images which may include thumbnail sketches, preliminary sketches, color layouts,

fabric swatches, prototypes, or even potential costumes. During this stage the designer collaborates with the director and other designers.

- 3) **Finalize the costumes:** The costume designers and costume shop staff select fabrics and patterns to create original costumes; refine prototypes until satisfied with an end result; or select final costumes from previously chosen options and fit these to the actors.

The costume designers observed in these studies faced several challenges: time, budget, and the match between actors' body types and available clothing. In premiere theatres such as those on Broadway, these constraints are likely lessened; however, community, academic, and smaller professional theatres are more common than theatres with larger budgets and long production times.

Time presents two challenges for costume designers in smaller theatres. First they work within the constraints of short production deadlines. The costume design process in the first two case studies went from beginning to end in 8 weeks and in the third case study in 12 weeks. A number of participants worked on more than one production at the same time and/or held a second job which further restricted the available time.

Second, theatre work often occurred during the evening or night reflected in the fact that the majority of observations, organized to take place when the participants were working, occurred after 5:30 pm. This schedule creates a time conflict with brick and mortar institutions such as libraries and museums where designers might access resources. As the costume designer in the third study stated, "And because of my schedule... a lot of times I can't go to places; like go to a museum. I rely on the Internet

and thank goodness that there is so much out there.” When the designer in the second case study used the library it was on a Saturday afternoon and she stated, “I was trying to get out of the library kind of fast. I limited myself to half an hour. Ideally I would have thumbed through the books at the library, but I did a grab-and-go if the book had potential.” Participants used the resources available to them during their work hours. Because traditional resources such as libraries and museums are often closed evenings and weekends, the resources used were often online or part of a personal collection.

The costume designers observed also had to work within tight budgets, which ranged from \$24-\$190 per character. Budget and time constraints limit costume designers’ options. In the first two case studies the designer compensated for this by reusing existing costumes. This leads to a constraint discussed by both designers which is the fit of the available clothing. Actors come in a wide range of sizes and in addition to collaboratively developing and refining an image of the costume that fits the character and production, a costume designer must then locate or build a costume which fits the actor. As the designer in the second case study said several times, “It came down to size issues.”

6.1.2 The Importance of Collaboration

Within the case studies, each stage of the costume design process included collaborative activities. While understanding and researching the play, collaboration typically included a presentation of initial ideas and discussion of findings by the director and designer. While creating designs, collaboration involved integrating the initial ideas into the rehearsal process. The number of individuals involved in collaboration during this stage typically increased to include the entire production crew. Collaboration while

finalizing the costumes included the costume designer, the director, the actors, and the costume shop staff. Outside the scope of this study, but worth noting, is that the final costumes are presented to an even greater number of people, the audience, in a final collaboration which is the production itself. Thus, as a play progresses, images are increasingly refined and finalized as the number of collaborative participants increases.

Because of the central role of collaboration to the costume design process, the relationship between the parties involved affects the resulting costumes as well as the efficiency of the process itself. The case studies presented a range in the strength of the collaborative relationships as indicated by length of time participants knew each other and how much time the costume designer spent at the theatre. In the first case study, the designer had worked with the director previously, but not with the costume shop staff. The relationship between the costume designer and the rest of the theatre staff was short term and sporadic. She worked only on this 8-week production and only went into the theatre when she had to interact with someone. In the second case study, the costume designer had a long-term relationship with a number of the other theatre staff but only a sporadic relationship with the costume shop staff. She spent more time physically at the theatre building costumes than she had in the first study. In the third case study, the costume designer was a member of a professional theatre group which had worked together on multiple productions over a number of years. Her office was located in the theatre and she had long-term relationships with every member of the theatre staff, even those who were not members of the group. The number of image changes that resulted from miscommunications reflect the difference in relationships, as do quotes pulled from the final interviews.

The costume designers were not asked directly about their satisfaction with the results of the costume design process, but when discussing costumes and the resulting production during the final interview, certain phrases reflect their perception at the time. Both the counts and phrases are presented in Table 12.

Table 12: Miscommunications and Costume Designer Satisfaction with Results in Case Studies

Case Study	Changes Due to Miscommunication	Representative Phrases from Final Interviews with Costume Designers
First (Pilot)	3	The end result, in everything that happened, I wasn't happy with.
Second	1	The silver dress was so perfect and elegant. These three worked together with the [pattern] but these three colors worked together...[they were] never quite right.
Third	0	But, again, it's exactly how I had imagined. To me, I think that it's all successful

These results do argue that aiding costume designers in developing and maintaining their relationship with other members of the production staff, both for an individual play and over time, may improve the communication of costume designers' vision from development of the mental images through the execution of the final costumes and reduce miscommunication.

In addition to collaboration within a production, improving costume designer's ability to collaborate across productions, in order to overcome challenges inherent in work practice stands out as a key aspect that would benefit from technological support. According to Wenger (1998), one of the three key aspects of a community of practice is its shared collection of resources including routines, words, tools, methods, gestures, and objects (p. 83). During their work, costume designers are often physically separated from other costume designers lessening their ability to share resources.

In the first two case studies, personal networks were used to share resources in order to overcome the challenges discussed in Section 6.1.1 . When describing the difficulty of locating clothing in a short period of time, the costume designer in the first study stated, “Originally I didn’t think I’d be able to find anything, and then I found a few things that we could pull...from two different theatres, one of which luckily I had a contact through...a friend of a friend, and they actually do Shakespeare.” She used contacts and knowledge of collections through previous theatre work to locate costumes for the second case study as well.

In these instances, costumes built for one play were selected and adapted for reuse in a new play. Many of the images, regardless of format, seem to be used, adapted, and reused over time. The model presented in Chapter 5 discusses this reuse as part of an individual designer’s set creation; however, use and reuse also occurs across plays and across communities of practice through social networks. In the example on page 99, reprinted below, the director decided to purchase a book the costume designer showed her during a production meeting. The images from this book will be used to inform other productions, perhaps from a director’s point of view or perhaps from the point of view of a different community of practice. The director on Case Study 2 was an actor in Case Study 3. The producer in Case Study 2 was the set designer on Case Study 3. Images cross between communities of practice in theatre, not only through the exchange of information across boundary lines but also when individuals participate in different communities of practice. When a theatre group produces a play, they create and share images and other information as part of a negotiation process to develop and present a

shared vision to the audience. As has been discussed, this sharing also extends outside a single production.

The example above, which occurred within a college theatre group, also illustrates another important aspect of the costume design community of practice, which is the role of mentoring and personal networks in acquiring and increasing skills. The costume designer in the first and second case studies learned her art by working with a mentor and “by listening to her talk to directors and watching her do research.” When she runs into a challenge, she continues to ask her mentor for advice as well as other professionals with whom she has regular contact through a stitching group. The costume designer in the third case study took a costume class as part of her general theatre degree but mainly credited her experience to growing up sewing and being a visual person. When she has a challenge with which she needs assistance, she reaches out to an experienced member of her family or theatre ensemble for support. Thus, personal networks within the larger community of practice provide costume designers with access to information and resources they need to resolve challenges they encounter in their work.

6.1.3 Image Search and Other Findings

This study set out to understand how costume designers search for, select, obtain, and use images within the broader context of cognitive and affective visual communication across communities of practice. Previous studies in image search and selection centered on the resource being used, such as a specific search engine or library, rather than how that particular resource fit within a larger framework of the users’ information needs (Keister, 1994; Armitage, and Enser, 1997; Fidel, 1997; Collins, 1998; Markkula and Sormunen, 2000; Goodrum and Spink, 2001; Chen, 2001; Choi and

Rasmussen, 2002; Hertzum, 2003; Cunningham, Bainbridge, and Masoodian, 2004; Goodrum, 2005; Jorgensen and Jorgensen, 2005; Cunningham and Masoodian, 2006; Westman and Oittinen, 2006). This study supplemented existing research by focusing on the user and the images' roles in the design process in order to better understand search and selection within the broader context of image use.

Costume designers are ideal candidates for this research because they use a variety of visual resources for their work and because the images used convey both cognitive and affective information. The costume designers who participated in this research used online resources, videos, written and verbal resources, and institutional and personal collections. Participants used the images that came from or evolved from these resources primarily to represent information. Based on discussions with designers about the images they used, the designers used visual elements within images to convey affective information between 30% and 50% of the time. In addition, they used images to affect negotiations, suggest information, and affect the viewer.

Once images were selected they were often changed in one of several ways. They were altered or eliminated and occasionally they were entirely re-conceptualized. In addition, images changed format, often from analogue to digital or from digital to analogue. These changes resulted for practical reasons, in order to clarify meaning, from a negotiation process between participants, due to miscommunication between participants, and in order to increase attractiveness. The variety of resources used and the varied context of use help validate prior studies' results in image search and selection.

Costume designers, like participants in previous studies (Masoodian, 2006, p. 199; Markkula and Sormunen, 2000, p. 274; Westman and Oittinen, 2006, p. 105;

Jorgensen and Jorgensen, 2005, p. 1354) relied heavily on browsing to select images. Regardless of the resource used, the costume designers assembled as comprehensive a set of images as possible and browsed the results. In the case of online searches, designers browsed multiple pages of search results. In the case of institutional and personal collections, designers browsed the entire relevant set of images. Image searchers' desire to create a comprehensive set was noted in two other studies (Westman and Oittinen, 2006, p. 109; Hertzum, 2003, p.175). It accounted for a tenth of the requests in the first and was mentioned only in passing in the second. Costume designers must locate multiple related, relevant images to inspire and inform a show rather than one or a few images to illustrate a point. The higher number of images needed may account for the difference in the search strategy, but this bears further exploration. It is also possible that assembling as comprehensive a set as possible is important to many image searchers but previous studies did not find this because the participants did not articulate it directly in their verbal requests and could not articulate it in search engine queries.

Previous research found that searchers used associated text when selecting images (Markkula and Sormunen, 2000, p. 277; Choi and Rasmussen 2002, p. 705; Westman and Oittinen, 2006, p. 106). Costume designers used associated text to select images and to supplement the information provided in the images. In addition, they tagged and added notes to the images they selected, further building on the text associated with the image.

Cunningham, Bainbridge and Masoodian (2004) noted that query by example occurred in 10% of 404 queries submitted to Google Answers' Visual Arts (p. 48). This study also found several examples of participants attempting query by example, either by describing a known image or using an existing image to locate another. Since current

commonly available search technology does not support this behavior, the fact that it happens at all indicates that search technology supporting visual search might well fulfill an unarticulated need within image search and retrieval. Other studies have focused on analyzing queries by the types of terms used and have found that image searchers tend to query for images by pre-iconographical and iconographical terms and only rarely use iconological and visual elements in searching. Though significantly fewer queries were observed than analyzed in previous studies, costume designers generally followed this trend by generally searching by time period, location, or object.

This study explored the relationship between visual elements and information within an image. Participants intentionally used specific visual elements within images, such as color, coverage, patterns, texture, decorations, and shape to convey information about characters, relationships, and movement. The association between specific visual elements and the information conveyed may be relevant only within the context of an individual production, as was the case when silver and gold were used to differentiate between two opposing groups of characters, but it may also reflect associations that fit within the larger culture that are leveraged by the designers. An example of this might be the color red and jagged lines being associated with a temperamental, “fiery” personality. These more general associations could be leveraged by visual search technology to rank or group results. For example, images with more red could be placed ahead of images with more blue when a user puts in search terms such as angry, fiery, or temperamental.

The central role of comparison stood out in this study more so than in other search and selection studies. During Markkula and Sormunen’s (2000) study of journalists selecting images to illustrate stories, they noted that, “one or more candidate photos were

selected. They were printed on paper or kept in mind and retrieved later. Candidate photos were compared later and finally those to be published were selected (p. 275).” The use of comparison was much more central in costume designers’ search process. They would compare multiple images before selecting an image to add to their overall image set and then compare selected images to make future decisions. The quote from Markkula and Sormunen also illustrates the use of an intermediate set of images held between the initial search and the final selection of images used. Set building was central to the costume designers’ search and selection process and has not been called out in many other studies, perhaps because of the methodology used.

This research set out to understand search and selection within the context of collaborative use, but what became apparent was the central nature of collaboration to the search and selection process itself. This is addressed in the following section.

6.2 Vision for Technological Support for Costume Design

Collaborative technology has the potential to expand costume designers’ networks and strengthen existing ties between the individuals in these networks by facilitating and expanding upon the information sharing that already occurs as part of the costume design practice. As was noted earlier, the degree of separation within the larger theatre community in the region studied was surprisingly small. Theatre professionals move between theatres for various productions, so may work with someone and then work with him or her again several months or years later. Technology could provide a means to stay connected. This section explains how the model and guidelines relate and can be used to support each stage of the costume design process and strengthen collaboration

within the larger costume design community. The model and guidelines are reprinted on the following pages.

Table 14 indicates which guidelines apply to each stage of the model for image search, selection and use in costume design practice. In the following discussion the items in italics refer to sections of the model (Figure 27) and guidelines for a costume designer's workbench (Table 13).

1. Supporting Collaboration and Negotiation fits almost exclusively within the *c. Visual Communication* stage of the model. Mechanisms to support synchronous and asynchronous communication, display work during face-to-face meetings, track changes, and call out specific portions of images and supplement their meaning through gesture all support the negotiation process that occurs between participants during costume design. The results of these negotiations alter image sets and lead to further search and selection.

2. Supporting Collecting and Sharing spans all three stages. Facilitating designers' ability to capture and store images supports *a. Search and Selection*. Capabilities to search and browse collections assists with *b. Collection Management* but also loops back into the search and selection process. Facilitating sharing images or information about images supports *c. Visual Communication* between individuals working together on a production and potentially supports developing a shared repertoire in a larger community of practice. Developing a larger costume design community with clear regulations on image sharing and use, supports *c) Visual Communication* but also provides additional resources for the *a) Search and Selection*.

3. Facilitating Interaction with and between Multiple Media Types and *4. Assuming a Part is as Important as the Whole* supports every stage of the model.

Costume designers use a wide variety of resources and must be able to display, interact with, and transition seamlessly between all types of media at all times. They must be able to interact with only a small segment of these media types or with their entirety.

5. *Supporting Notes and Tags* allows costume designers to associate text with images at any stage within the model. The designers observed added notes, and tags to images primarily during the search and selection stage but they could potentially do so during Collection Management or while collaborating with other participants. While not a part of current practice, added text could also support future search activities and, within an online community, facilitate searching across other individuals' collections.

6. *Facilitating Mobile Capture and Display* applies to the *a. Search and Selection* and *c. Visual Communication* stages. While searching analogue collections, conducting interviews, observing behavior and dress, or any of a number of other search activities, costume designers require the ability to record objects, text, and activities. They need to be able to then display images and sets of images in a variety of locations where visual communication may take place and where plugs and tables may be scarce. They also need to easily transition between analogue and digital formats.

7. *Facilitating Grouping and Regrouping* primarily supports *b. Collection Management* but since the negotiation process sometimes leads to set refinement providing the ability to easily group and regroup images supports *c. Visual Communication* as well. Allowing costume designers to manipulate images within sets without affecting those images elsewhere allows set manipulation “on the fly” during a meeting without any risk of losing other work.

8. *Facilitating Comparison* affects costume designers' ability to work effectively at any stage in the model. Costume designers compare images in order to make selections during *a. Search and Selection* and while making changes during *b. Collection Management*. During *c. Visual Communication*, participants also compare images to aid discussion and further refine sets.

The final two guidelines, *9. Supporting Search Using Existing Information* and *10. Facilitating Serendipitous Finds* support the specific strategies observed within the *a. Search and Selection* stage of the model. Allowing costume designers to search using an existing image or portion of an image and expanding on search queries using associated terms would expand the set of relevant images with which they must work. Providing a recommendation and rating system for images would leverage the larger community of practice to present images that may inspire costume designers or meet unarticulated information needs.

Ideally, a costume designer's workbench as described above would support costume designers work practice and provide them with a way to improve their networks without expending extra time or resources to do so. If technology can help designers build and strengthen ties with others through information sharing, then it can also assist them in overcoming their time, budget, and availability constraints by increasing the number of resources available to them. It may also serve to provide a communication medium to increase the mentoring and informal learning integral to developing proficiency in costume design practice.

FIGURE 27 (REPEATED): MODEL OF IMAGE SEARCH, SELECTION, AND USE IN COSTUME DESIGN PRACTICE

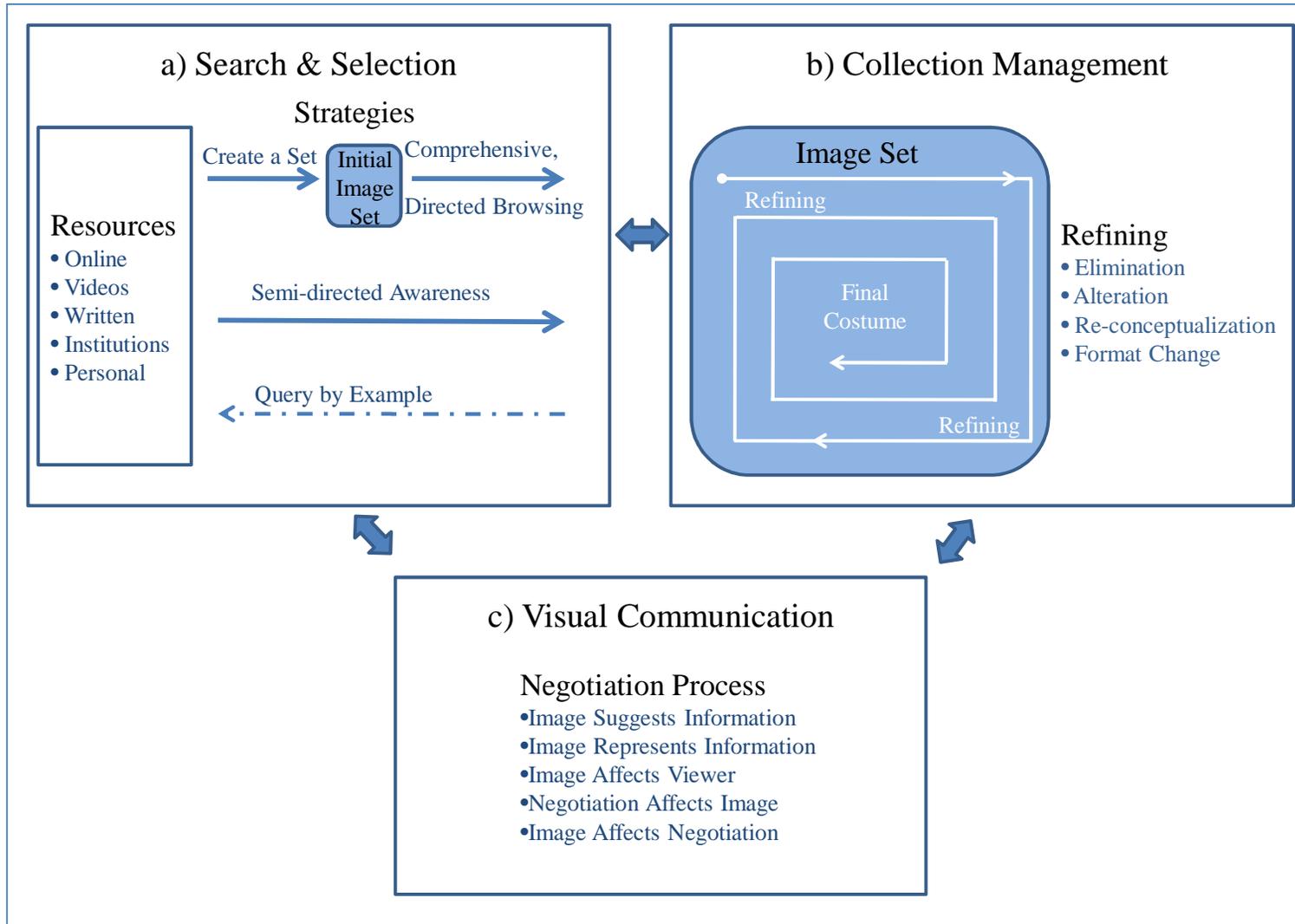


Table 13: Guidelines and Key Features for a Costume Designer's Workbench

Guideline	Key Features
1. Support Collaboration and Negotiation	<ul style="list-style-type: none"> • Mechanisms for synchronous and asynchronous communication between two or more participants • Ability to display work and easily make changes during face-to-face interactions • Change history and the ability to revert to a previous state • Mechanism to indicate a specific portion of image or video • Supplement remote communications with video capture associated with a specific image or portion of the image
2. Support Collecting and Sharing	<ul style="list-style-type: none"> • Ability for designers to build and maintain collections through fast methods for capturing, and storing images • Search and browse capabilities in individuals' collections • Connection with a larger costume design community with clear regulations on image sharing and use • Optional mechanism for sharing images with specific designers within the community or the community as a whole.
3. Facilitate Interaction With and Between Multiple Media Types	<ul style="list-style-type: none"> • View multiple images as well as associated text and audio during search and selection • Interact with and transition seamlessly between all types of media • Ability to “collage” multiple media types
4. Assume a Part is as Important as the Whole	<ul style="list-style-type: none"> • Ability to specify, isolate, and interact with specific segments of an image
5. Support Notes and Tags	<ul style="list-style-type: none"> • Ability to add multiple notes and tags to a whole image or part of an image • Contextual awareness and presentation of notes and tags • Ability to search and group based on notes and tags
6. Facilitate Mobile Capture and Display	<ul style="list-style-type: none"> • Mechanism for mobile image capture of objects, text, and activities • Mechanism for mobile image display • Ability to easily transition between analogue and digital
7. Facilitate Grouping and Regrouping	<ul style="list-style-type: none"> • Ability to create sets of images in which images may exist in multiple sets at the same time • Changes to or removal of an image in one set should not affect the image in another set • Support regrouping by multiple participants • Ability to title the set
8. Facilitate Comparison	<ul style="list-style-type: none"> • Ability to display as many images as the available screen will allow • Ability to compare images using a smaller screen • Ability to set aside images in a temporary queue
9. Support Search Using Existing Information	<ul style="list-style-type: none"> • Ability to use an existing image or portion of an image to search for other images • Text mining to expand on searches
10. Facilitate Serendipitous Finds	<ul style="list-style-type: none"> • Recommendation and rating system

Table 14: Mapping of Guidelines to Stages in Model

	1) Search and Selection			2) Collection Management	3) Visual Communication
	Creating a Set and Browsing	Semi-Directed Awareness	Query By Example		
1. Support Collaboration and Negotiation					APPLIES
2. Support Collecting and Sharing	APPLIES			APPLIES	APPLIES
3. Facilitate Interaction With and Between Multiple Media Types	APPLIES			APPLIES	APPLIES
4. Assume a Part is as Important as the Whole	APPLIES			APPLIES	APPLIES
5. Support Notes and Tags	APPLIES			APPLIES	APPLIES
6. Facilitate Mobile Capture and Display	APPLIES				APPLIES
7. Facilitate Grouping and Regrouping				APPLIES	APPLIES
8. Facilitate Comparison	APPLIES			APPLIES	APPLIES
9. Support Search Using Existing Information			APPLIES		
10. Facilitate Serendipitous Finds		APPLIES			

6.3 *Limitations*

The researcher selected an exploratory, naturalistic paradigm for this research in order to understand how costume designers use images across the entire design process and independent of any given system. The researcher selected this qualitative methodology because, to the researcher's knowledge, this topic area is relatively new. Additional qualitative studies are needed in order to learn more about costume designers' needs and to test the conclusions presented herein.

Because of the nature of qualitative research, the findings presented in this dissertation may be transferable but are not generalizable. Additional research is needed to validate and refine the findings with additional costume designers. Also, additional research is needed to determine whether the results are transferable to larger theatres with more resources than those studied. These findings may also provide a starting point for creating more general theory of image search, selection, and use in design practice. In order to achieve this, qualitative and quantitative studies with a variety of designers in a variety of theatres must be conducted.

The naturalistic paradigm recognizes the researcher as part of the research itself. Because the researcher for this study has a background in costume design, previous preconceptions may have affected the results. This may have also been complicated because the researcher partially used personal networks to gain access to the case study groups and the participants for these case studies overlapped. As noted in the case study description, the theatre community within the Washington Metropolitan area studied has a close-knit personal network. This may lead to standardization in design practice. Case

studies in other regions may yield different results and this possibility should be used to select new cases for future research.

The researcher coordinated observations with the participants to minimize intrusiveness. Since many activities occur spontaneously, it was difficult to ensure representative coverage of various events. Because of this, the researcher placed less weight in analysis on the number of times an event occurred within a given case study and more on whether an event occurred across multiple participants and multiple case studies. The guidelines resulting from these case studies assume that every event that occurred should be supported. Additional case studies and a more quantitative methodology is needed to validate the guidelines.

6.4 *Future Research*

Future research should both validate and expand on this study. As mentioned in the previous section, case studies and interviews with additional costume designers should be used to validate the guidelines. Both the model developed in Section 5.1 and the guidelines in section 5.2 may be applicable to larger design communities, but in order to discover this, qualitative and quantitative research must be conducted with designers in a range of fields. Product design, video game design, and interior design would serve as good starting points.

The effect of participants' relationships on the design process presents an opportunity for further exploration. Are certain relationships such those between the director and the costume designer or between the costume designer and the costume shop staff more important than others? Is time spent physically located at the theatre more important than the relationships? If the importance of relationships is confirmed,

research should focus on how technology can best support the development of relationships within short production times and over careers.

The overarching goal of this research was to inform the development of software to support costume designers. The next step in this goal is creating a prototype of the costume designer's workbench and testing it with various costume designers. As noted in the discussion, images and individuals cross communities of practice within the theatre community. A prototype's success may rely on its ability to support all types of participants. Iterative testing and refinement will be required. This type of research will also feed back into refining the guidelines and the resulting system could also be tested with various types of designers.

Four areas in particular need further exploration:

1. The relationship between image use and search strategy,
2. The relationship between affective information and visual search and selection
3. How to best support comprehensive browsing, and
4. Whether a taxonomy of visual elements and search terms could be developed to expand text search for images.

This case study touched upon, but could not fully explore, the relationship between image use and search strategies. The taxonomy of image use presented in Table 9: Image Use Codes and Examples should be used to conduct a more experimental study on search strategy. By controlling the intended use of the image, variations in search behavior may be more apparent.

This study affirmed that affective information plays a role in image use as a communication tool, but it was unable to explore the relationship between affective information use and search and selection strategies. The participants in the research study never discussed the affective criteria in image selection, yet they utilized certain visual elements within an image when creating new images to convey affective information. It was unclear from this study whether the original image was selected based on a, perhaps subconscious, affective response or whether selection based on affective information only occurred after the original group of images was created. It may be that affective information needs are secondary to cognitive information. The reliance on time and setting when searching supports this possibility.

This study also affirmed that costume designers browse multiple pages of online search results and entire collections of analogue resources. Most search engines present results in list form, but costume designers may benefit from different methods of displaying image results. They might also benefit from feedback about how much of a result set has been viewed. Further work is needed in this area.

Finally, costume designers' use of specific visual elements to convey cognitive and affective information to collaborators and to audiences implies that visual search technology could be used to augment text searches for images. Research from psychology and sociology could be leveraged to develop and test taxonomy of visual elements to search terms. While some associations may be personal or situation specific, others might extend to a culture. Even if taxonomies can only be applied on an individual basis, search software that improves performance over time might take advantage of such a mapping.

6.5 *Summary*

As mentioned in the introduction to this chapter, thousands of plays are created or recreated each year bringing in millions of dollars in revenue for theatres and their surrounding communities. All of these plays require some level of costume design; however, little research has been conducted to understand or support this community of practice. Exploring technological support for costume designers presents an opportunity to assist an often overlooked community, but also provides insight into image search, selection, and use as a visual communication tool. This research confirmed that findings from previous studies, regarding the importance of browsing and associated text-to-image search and selection, apply across a wider variety of resources and in a context that involves more affective information needs than previously studied. It also suggests that comprehensive set building may be more central to image search strategies than previously noted.

The central contribution of this dissertation is a model of image search, selection, and use in the costume design process and emergent guidelines to support it. While the model and guidelines focus on individual costume designers, the central role of collaboration across the theatre community within a production and across productions, implies the findings might be expanded through future research to apply to all theatre production staff. In addition, if extended through additional qualitative and quantitative studies, this work could help support a much broader range of designers, illustrators, artists, and other visually centered professionals through development of improved visual search, retrieval, and communication tools.

Appendix 1: Interview Questions

Please note these questions were used as a starting point. Additional questions were asked based on the flow of the conversation.

Initial Interview

- Can you tell me a bit about your background in costume design?
 - Did you study or train in costume design anywhere?
 - How long have you been designing?
 - Are there any costume methodology books you use or recommend?
- Do you ever turn to anyone for advice/assistance when you are designing a play?
 - Are you a member of any costume or theatre groups?
 - Do you maintain contact with other designers?
- Have you designed or worked on this play previously?
- What have you done so far?
- What are your next steps?

Final Interview

1. Looking at these images, would you describe how your ideas and designs evolved over the course of the play?

Prompts:

- Did you change any pulled costumes? Why?
 - Did the rehearsal process affect your designs? If so, how?
 - Did you have anything that you built or pulled and didn't use?
 - Did you ever refer back to your [images, image book, the forum] or other source when you were designing or pulling?
2. What did you consider successful and what did you consider unsuccessful? Why?
 3. Approximately how much time did you spend on each task?

Appendix 2: Changes to Marsh and White Taxonomy

*Rows in dark gray were not included in the final taxonomy

Term	Revised Definition
A1 Decorate	Make a presentation or image more attractive with no further purpose.
A1.1 Change pace	Shift an existing conversation to a new topic.
*A1.2 Match style	This code is not applicable.
A2 Elicit emotion	Suggest an emotional quality, effect, or response.
A2.1 Alienate	This code is not applicable.
A2.2 Express poetically	Suggest a spiritual quality, effect or response.
A3 Control	Use A3.1-3.2 instead of this code.
A3.1 Engage	Draw and/or hold the viewers' attention.
A3.2 Motivate	Initiate a conversation.
B1 Reiterate	Restate with minimal change or interpretation. (no change)
B1.1 Concretize	This code is consolidated with B5.
B1.1.1 Sample	This code is consolidated with B5.
B1.1.1.1 Author/Source	This code is not applicable.
B1.2 Humanize	This code is consolidated with B5.
B1.3 Common referent	This code is not applicable.
B1.4 Describe	This code is consolidated with B5.
B1.5 Graph	Translate numeric data into a image representation (no change)
B1.6 Exemplify	This code is consolidated with B5.
B1.7 Translate	This code is not applicable.
B2 Organize	Use 2.2-2.4 instead of this code.
B2.1 Isolate	Use B3.2 instead of this code.
B2.2 Contain	Define or keep within limits.
B2.3 Locate	Set or establish in a time or place. (no change)
B2.4 Induce perspective	Suggest relative importance.
B3 Relate	Use B3.1-3.2 instead of this code.
B3.1 Compare	Suggest a similarity or relationship.
B3.2 Contrast	Suggest a difference or separation.
B3.3 Parallel	This code is not applicable.
B4 Condense	Reduce to or present essential elements.
B4.1 Concentrate	Use B4 instead of this code.
B4.2 Compact	Use B4 instead of this code.
B5 Explain	Provide example or illustration of complex ideas or concepts.
B5.1 Define	Use B5 instead of this code.
B5.2 Complement	Use B5 instead of this code.
C1 Interpret	Use B5 instead of this code.
C1.1 Emphasize	Use B4 or A2 instead of this code.

Term	Revised Definition
C1.2 Document	Provide factual information.
C2 Develop	Use B4 instead of this code.
C2.1 Compare	Use B3.1 instead of this code.
C2.2 Contrast	Use B3.2 instead of this code.
C3 Transform	Use B5 instead of this code.
C3.1 Alternate progress	This code is not applicable.
C3.2 Model	Use C3.2.1-3.2.2 instead of this code.
C3.2.1 Model cognitive process	Provide image representation of abstract process.
C3.2.2 Model physical process	Provides image representation of material or mechanical process.
C3.3 Inspire	Use A1.1 instead of this code.

Appendix 3: Summary of Design Stages

Summary of Design Stages based on Case Study Research	Summary of Design Stages Based on Reading	Costume Designers Handbook (Ingham and Covey, 1992)	Magic Garment (Cunningham, 1984)	Costuming for Film (Cole and Burke, 2005)
1 Understand and research play	1 Understand the play	1.1 Play-script analysis	1.1 Read and study the play	1 Design analysis <ul style="list-style-type: none"> ▪ Read the script ▪ Conference w/ director
		1.2 Understand the production <ul style="list-style-type: none"> ▪ Design conference 	1.2 Collaborate among designers and director	
	2 Research the costumes	2 Systematic costume research	2 Research	2 Preliminary research <ul style="list-style-type: none"> ▪ Understanding clothing practices ▪ Tonal research
2 Create designs	3 Create preliminary designs	3 Preliminary Sketching and Color Layout <ul style="list-style-type: none"> ▪ Thumbnail sketches ▪ Preliminary sketches ▪ Color palette/ color layout ▪ Fabric swatches 	3.1 Develop the costumes	3 Preliminary design <ul style="list-style-type: none"> ▪ Preliminary sketches ▪ Collaborating w/ producers directors, other designers
			3.2 Unify the whole	
	4 Create final designs	4 Final Sketches	4 Render the costume sketches	4 Polishing the Design <ul style="list-style-type: none"> ▪ Design costumes ▪ Final design
3 Finalize costumes	5 Produce the costumes	5.1 Pre-production <ul style="list-style-type: none"> ▪ Finding, pulling, renting 	5.1 Choose fabrics for the costumes	5 Preparation <ul style="list-style-type: none"> ▪ Meet with actors ▪ Gather costumes ▪ Fittings ▪ Alterations
		5.2 Production <ul style="list-style-type: none"> ▪ Building ▪ Fitting and altering 	5.2 Get the show together	

Appendix 4: Pilot Study Findings - Original Coding

Because one of the results of the pilot study was a revision of the research questions, the results discussed below are tied to the foreshadowing questions used for the pilot study. The data will be recoded using the coding scheme that evolves from the two case studies to provide an additional case for comparison.

The Costume Design Process

The design process started with an initial concept meeting between the director and the designer. This meeting focused on conveying the director's thoughts to the designer, but the designer also showed the director several pages from a book to ensure they, "were on the same page about time period."

Next, the designer used the Internet and her personal library to, "find all the images [she] liked of everything and then...pare that down or group that up." Selected images were printed out or photocopied and then collaged based on character. The resulting collages were used as boundary objects during the second meeting with the director to determine if the designer understood the director's vision for each character and to discuss differences in their ideas.

After this meeting, the designer conducted a second round of research on characters whose designs the director did not like. The designer then rendered all of the costumes. After a third meeting, several renderings were revised. The designer then began buying fabric and patterns and identifying available costumes that could be used or adapted for the show. The renderings were shown to the costume shop staff to, "talk through things, to explain where things were going." Because of time constraints, the designer had to compromise, "We realized that the shop didn't have time to make everything... even

though these are the final vision of what we hoped to have, it changed a lot in what the final product was.” The designer used images throughout this iterative process to articulate and increasingly refine her vision of the play.

Image Search and Selection

Two search sessions were observed, the first when the designer used the Internet, and the second when she used her personal library. During the Internet session, the designer searched **Google Images** for “1592 England” and browsed through four pages of results, bookmarking interesting pages. She watched videos, browsed thumbnails, and read text. She also viewed larger versions of images and examined several images in detail before selecting any one. When she located a relevant image, she printed it and sometimes labeled it.

When searching books, the designer marked selected pages with sticky notes which were occasionally labeled. She looked through entire books and flipped back and forth among pages. At one point she had three books open and changed one of her labels. While searching her book collection, the designer stated that she tried to collect books relevant to what she does and selected books to use based on the play’s time period or setting.

The strategy of:

1. Creating an initial set of images based on time period,
2. Selecting an initial set of images through browsing, and
3. Comparing images to make final selections,

remained consistent in both virtual and physical media.

The heavy emphasis on browsing after an initial search conforms to findings in [Jorgensen and Jorgensen, 2005; Markkula, M. and Sormunen, 2000; Westman and Oittinen, 2006]. Markkula and Sormunen (2000) reported that journalists also printed images for later comparison during final selection. These findings imply that effective image retrieval systems should facilitate browsing images and creating a set of images for later comparison and selection.

Tagging

The designer tagged images as a natural way of organizing her work. She assigned 22 labels to selected images:

- Twelve tags were names of characters, such as “Kate” or “Bianca”;
- Five were names of groups of characters, such as “players” or “serving women”;
- Three were articles of dress, such as “slashed sleeves” or “hat”;
- Three were characters modified by an article of dress, such as “Columbine (w/ high collar)”; and
- One was labeled “silhouette”.

An image retrieval system which allowed tagging as part of the image selection process could provide meaningful access for other designers while not creating additional work for designers creating the tags.

Role of Text

The designer used text heavily when evaluating images during both physical and virtual search and retrieval. The designer repeatedly referenced the play itself, which provided information about the characters, time period, and specific costume pieces

needed. In addition, text associated with the located images provided visual information to supplement or explain the images:

Some of the books I [own], have a lot of text in them and very few pictures. And the text can just be telling me what colors were the colors of the time period or the necklines and sometimes it gives me information that you can't quite get from an image. But it just all kind of makes everything go together better if you have the written statement of [how or whether] they wore the petticoats so that no one could see their ankles.

This reliance on text corresponds with Choi and Rasmussen's (2002) finding that most users use both images and associated text when evaluating an image's relevance. The importance of text to image evaluation implies that image retrieval systems should facilitate a smooth transition between an image and its associated text and perhaps even additional text sources not directly associated with the image.

Image Use

The designer used images to communicate increasingly refined concepts. At the initial stage, images were used as a starting point for communication. In fact, before the search and selection process described above began, the designer and the director brought several images to the preliminary meeting to communicate initial ideas. This meeting was not observed, but the designer stated that, "I showed [the director] a couple pictures out of a book that I had to see if we were on the same page about time period," and that, "the director provided some images as examples of her interpretation."

The words used at that meeting influenced the designer's search and selection process, even though words were not entered into a search engine or searched in an index within a book. "Sometimes it's a matter of getting them to say what they want in a different way or using different words, because that might actually influence you to go, oh now she's saying 'elegant' instead of 'fancy' or 'luxurious'. And then trying to find images that say much more 'elegant' than [one of the other words]."

At the second stage, groups of images were used to present both individual character concepts and an overall picture of the play as a whole. After the initial meeting, the designer selected and collaged images to, "present to the director and other artists on staff and say, 'this is where I think I'm going with these characters.'" She did this to ensure, "A) that these represent the characters that you are trying to get across and that B) all the characters work together as a unit in some way, shape, or form."

In the final stage, renderings were created to depict details about each character through dress. The designer described Kate's character as "fiery" and "strong" and stated that in the rendering of Kate's costume she tried to make, "everything much more jagged; edges on her costume or having a lace that had a jagged edge to it. Kind of doing something with the shoulder so it would be a bit more pointy

Figure 28: Rendering of Kate



and having a pointy collar around her neck (see Figure 28).” This description demonstrates a connection in dress between visual elements (e.g., line, color, form, shape) and linguistic or descriptive (i.e., text) based information. The designer’s additional comments further illuminate this connection:

- “One is a rich old man who is a fool so he should be all ruffly.”
- “There was something about the stance of both of these women that seemed very strong.”
- “I picked this image because I liked the way she was sort of swooning on her back. It seemed kind of feminine and...submissive.”
- “The servant guy who is in all lavender...light and feminine to make him feel kind of silly.”

Color

The designer used color to convey information about individual characters, as in the quote above, and also to show relationships between characters, “The one set of lovers will be in warm tones, like reds and oranges. The other set of lovers will be in cool tones....The servants will be in pastels and so will the lady of the house because they are away from a darkness of the rest of the Elizabethan world at that time. “

The subjective nature of the terms used to describe images throughout this case study illustrates a key problem in indexing or searching for images. Searching against associated text for descriptive elements such as color, mood, and other descriptive terms as well as facilitating tagging may partially resolve this problem. The connection between certain visual elements within the image and certain subjective descriptions also suggests that providing content based retrieval using color, shape, and line, or retrieval by example may also be useful for this type of searching.

Appendix 5: Coding Dictionary

This appendix presents the definitions used to code the data presented in Chapter 4.

Initial definitions were created based on research then refined through close examination of the data. They were then further refined through coding by and discussion with a second coder.

Visual Elements

- **Color:** References to the shade, shadowing, intensity, or hue of an image or part of an image.
- **Coverage:** References to the amount of area covered or not covered by a part of an image. This typically referred to the amount of skin exposed by a costume piece.
- **Pattern/Texture/Decoration:** References to patterns, textures, and decorations within an image. If the reference is to the overall outline of a garment, use Shape.
- **Shape:** References to a shape, including lines, within an image. This typically referred to the silhouette of a costume or part of a costume.
- **Perspective:** References to the angle or view from which an image is created.

Types of Information Represented

- **Character Description:** Factual information about the character such as age, social status, job, or species. Include character's fiscal, temporal, or social evolutions.
- **Character Personality:** Information about the personality or emotional qualities of the character, such as the character's temperament or shyness. Include character's emotional evolution.

- **Relationship Between Characters Exists:** Information that indicates that two or more characters are related in some way. This can show similarity or differentiation between groups. It should not indicate the relationship of a character to the setting.
- **Quality of a Character Relationship:** Information about the type of relationship between characters that goes beyond the association. For example, a relationship may be antagonistic or loving. If this is used, more often than not the Relationship Between Characters Exists code should also be used.
- **Setting:** Information about the time period or location of the play.
- **Movement:** Information about movement of an element within the image

Types of Image Use

Image affects Negotiation

- **Motivate:** Image is used to initiate a negotiation.
- **Change pace:** Image is used to shift an existing negotiation to a new topic.
- **Reiterate:** Image is used to restate a previous event within the negotiation with minimal change in order to clarify or record.

Image suggests Information

- **Decorate:** Image is included to make an image more attractive with no additional intent.
- **Contain:** Image is used to suggest limits.
- **Locate:** Image is used to suggest time or place.
- **Induce perspective:** Image is used to suggest relative importance.
- **Compare:** Image is used to suggest a similarity or relationship.

- **Contrast:** Image is used to suggest a difference or separation.

Image represents Information

- **Explain:** Image is used to represent complex ideas or concepts.
- **Document:** Image is used to represent factual information.
- **Model cognitive process:** Image is used to represent an abstract process. For example: an illustration of communication theory.
- **Model physical process:** Image is used to represent a material or mechanical process. For example: a diagram of how an engine works.
- **Graph:** Image is used to represent numeric information.

Image affects Viewer

- **Elicit emotion:** Image is used to evoke an emotional quality, effect, or response.
- **Express poetically:** Image is used to evoke a spiritual quality, effect or response.
- **Engage:** Image is used to draw and/or hold the viewers' attention.

Negotiation affects Image

- **Condense:** Image leads to reduce a set or to reduce a larger representation to essential elements.
- **Refine:** Image leads to changes to the image.

Types of Image Changes

- **Alteration:** Changing part of the content of an image to create a new image. The individual altering the image kept aspects of original image in some form. Typically this applies to a single image.

- **Re-conceptualization:** Changing the whole idea behind an image or replacing an image or set of images with a new image or set of images. In this case, an idea was created or presented and then changed.
- **Elimination:** Disposing of an image entirely. Typically this applies to one or more images from a set of two or more images.
- **Format Change:** Changing the format of the image without changing the content. An example of this would be photographing a sketch. The content has not changed but the format is now a photo rather than a sketch.

Reasons Images Change

- **Negotiation process:** The change resulted from discussions between participants in the design process. The change occurred during a discussion or as a direct result of the discussion.
- **Clarify Meaning:** The change was made in order to better articulate or clarify meaning. This might be articulated as a change made to one image or costume to better fit with other costumes or the overall production. The change typically occurs before or in anticipation of a discussion or presentation.
- **Practical Reasons:** The change occurred because of a practical constraint such as time, availability, skill, mobility, or because elements did not fit together in some way or work as expected.
- **Miscommunication:** The change resulted from a misunderstanding between parties involved in the design and execution of a costume. This applies to any mention of communication difficulties, misunderstandings, or surprise resulting from communications.

- **Attractiveness:** The change was made to improve the appearance of the costume or wearer.

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