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Visual Artifacts as a Mediating Factor in Collaborative Museum Design

Jacquelyn Claire Johnson

A dissertation submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

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ABSTRACT

Visual Artifacts as a Mediating Factor in Collaborative Museum Design

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Doctor of Philosophy

The process of museum exhibit design includes a variety of activities, including collaboration on teams, consulting learning theories, following process models, brainstorming, performing evaluations, and using visuals. Although some articles mention these topics, very few provide specific details about these practices. This dissertation, which includes three articles, explores how design and visual communication occur in exhibit design. The first article examines how exhibit design teams function. The second article describes how they use visual representations to engage team members in ideation and concept development as they planned for new exhibits. This is based on the assumption that designers need to be actively engaged in the design process to truly be creative and develop innovative ideas. Building off the second article, the third article provides practical implications and examples for professionals in the field. These articles seek to add insight on the design process and use of visuals in museum exhibit design.

Keywords: museum exhibit design, exhibit designers, evaluation, prototyping, visual representations

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DESCRIPTION OF RESEARCH AGENDA AND STRUCTURE OF DISSERTATION

Museum exhibit designers face increasing pressure to create innovative, educational exhibits to meet the needs and expectations of the millions of visitors who visit each year. Some designers are well prepared for these demands through formal training provided in museum studies graduate programs (Brennan, 2014). However, many exhibit designers enter this realm of museum work after they have already been in the field and do not receive deliberate instruction on how to design. They rely instead on exhibit design manuals that are written based on the experiences of colleagues and serve to “reinforc[e] the instruction that comes from peers and previous experience” (Bogle, 2013, xix). These designers need more support than is provided by extant literature to teach them the skills necessary to function as exhibit designers. While my research does not offer a comprehensive discourse on all the skills and practices exhibit designers should acquire to be successful, my dissertation seeks to describe the practices of exhibit designers and offer specific guidelines for doing this work. In addition, studying the group interactions that take place among individual designers in the museum field revealed greater insights that may apply to designers in other fields as well. These observations can support novice exhibit designers who are transitioning into design from other areas of museum work, as well as exhibit design team leaders.

In the first article of my dissertation, I report on my examination of the literature regarding the creative process of museum exhibit designers. I aim to publish this article in *Museum Anthropology*, *Design Studies*, or *The Museum Scholar*.

In the second article of my dissertation, I report on a study of practicing museum exhibit designers wherein I examined their use of visual representations as a means of exploring and

communicating about their ideas. I will aim to publish this article in *The Journal of Creative Behavior* or *Museum Anthropology*.

The third article is a practitioner article written for museum exhibit design team managers. It provides ideas for how to create a transformational culture of design, including aspects of transformational leaders and how they support individual designers in their professional development. I will strive to publish this article in *Design Studies*, *Exhibition*, *The Journal of Applied Design*, or *TechTrends*.

The appendix includes the two interview protocols used during the study, an in-depth description of how qualitative trustworthiness standards were met, and a copy of the Institutional Review Board consent form.

ARTICLE 1

The Creative Process of Museum Design Teams

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Abstract

Museums face increasing pressure to be engaging educational institutions that provide informal learning experiences for their patrons. However, not all museum exhibit designers receive formal training to prepare for this type of work. Many of them enter the realm of exhibit design after they join the museum field and are required to develop design skills on the job. Several of the resources they have do not provide adequate guidance about how to function in these roles on a day-to-day basis. To alleviate the strain of not having sufficient support, this article reviews literature on how museum exhibit designers perform their work. Findings suggest that exhibit designers collaborate on design teams, refer to learning theories, use design process models, brainstorm, perform evaluations, and use visuals. Further exploration of these principles as they relate to exhibit design would provide guidelines to help inexperienced exhibit designers transition into a successful career.

Keywords: museum exhibit design, exhibit designers, evaluation, prototyping

Introduction

American museums receive about 850 million visits every year, more than the annual visits made to sporting events and theme parks (American Alliance of Museums, 2016).

Museums accommodate a wide range of visitors, ranging from individuals and families looking for an educational, leisure-oriented cultural experience (Falk & Storksdieck, 2005) to researchers from prestigious universities. They face increasing pressure to be engaging and credible learning institutions rather than warehouses of artifacts (Carliner, 2001) or playgrounds (Callanan, 2012).

With this focus on informal educational experiences, museum designers are tasked with designing quality exhibits. Museum studies programs offer a solid foundation for museum work, including direct instruction on how to produce innovative and accessible exhibition designs (Brennan, 2014). Yet understanding design and museum theories, as well as gaining technical skills and practical experience is nothing without knowing “how to ask the right questions, seek the essential challenges, distill the real issues, and work with others towards creative solutions” (Brown & Austin, 2014, p. 43).

Developing this mindset is crucial for a successful career in exhibition design, but support through the process is not equally accessible to all designers. Entrance to the exhibition design field does not require a degree or certification (Carliner, 2000), and many designers do not graduate from museum studies programs that offer such support. They come from backgrounds other than design and are enlisted to work as exhibit designers after their entry into the museum field. As such, they miss out on discussions about strategic issues and changes in museum practice (Mckenna-Cress & Rice, 2014) and do not receive the experiences and training necessary to think creatively and plan innovative, successful exhibitions (Carliner, 2000). Their transition to the field is complicated by the evolution of design from a focus on object placement

and color for static displays, to a collaborative, open-ended, and highly customized process that is focused on the end user (Mckenna-Cress & Rice, 2014). Lacking the experiences of formally-trained designers, they rely on exhibit design manuals, which “reinforc[e] the instruction that comes from peers and previous experience” (Bogle, 2013, xix).

Most of the resources provide only very general recommendations and guidelines so nondescript that they are difficult to refute and provide only superficial direction regarding museum exhibition design (Mortensen, 2010). For instance, speaking of the installation phase of exhibit design, Bogle (2013) says:

During this phase the construction contractor installs all the exhibits and completes all the items detailed in the agreement with the institution. All planning and designing discussions and decisions are now finished; the exhibition is coming to life and will soon be a reality. Installation always seems to be an exciting time. The atmosphere appears to be charged, and the exhibit project team members and the installers usually work together in a busy, friendly, supportive manner. (p. 22)

The general and scattered nature of this museum design literature can be frustrating for exhibit designers seeking guidance. If exhibit designers are to create exhibitions that attract and educate visitors, it is critical that they receive training, approaches, and tools that fulfill their design needs. Providing this support is only possible through understanding the current state of the field and the specific practices of exhibition designers. Reviewing the literature on this field will reveal the values, priorities, and teaching practices of museum graduate programs, elucidate how designers function day-to-day, and expose areas of needed improvement and innovation.

In this literature review, we explore the question “What is the creative design process of exhibit design teams?” in order to better understand the nature of their work and provide a

foundation for future studies that will ultimately provide them with new resources. This literature review serves both to summarize what extant literature says about the creative design process of exhibit teams and to offer a critique of the literature to show gaps in what is known and what yet remains to be described. We explore how museum designers currently design to demonstrate their practices and then discuss my results. Based on our findings, we present future directions for research and identify areas of needed improvement.

Method

This literature review was performed between January and March 2016 by searching the databases listed in Table 1 with keywords related to museum design. We also searched the online archives of the *Journal of Museum Education and Exhibition* using a keyword search.

The search provided thousands of results. We removed all articles that were not peer reviewed and focused on articles written between 1995 and 2016. However, certain articles that were written before this time period were included because of their significant contributions. Our inclusion criteria were selected based on terms and concepts found in design manuals, as well as personal experiences as designers. Articles were excluded if they were not related to one or more of the topics of evaluation, museum space, design approaches, design models, prototypes, design challenges, and design teams. We also excluded articles that dealt with virtual museums and web-based museums since they do not face the issue of designing in physical space. The abstracts of all the articles were read, and those articles that matched the inclusion criteria were reserved. By the end of the process, 60 articles were selected as the focus of this review.

Upon reviewing these articles, we noted that many of them did not address the practical issues designers face in their day-to-day work. To fill this gap and understand these topics, we turned to manuals about museum planning and exhibit design.

Table 1

Literature Review Search Terms

Databases	Search Terms
ERIC, Web of Science, ProQuest, ABI	<ul style="list-style-type: none"> • “museum design” • “museum exhibition design” • “museum design and evaluation” • “use of space in museums” • “museum design and learning” • “spatial elements of museum design” • “use of space in museum design” • “museum design tools” • “museum design process” • “museum designers” • “museum education and museum exhibition design” • “creativity and museums” • “experience design and prototyping” • “experience design and museums” • “museums and prototyping” • “interdisciplinary team and prototyping”

Findings

A review of the literature revealed details about several aspects of the work of museum design teams. In general, the articles talked about specific projects that had been completed in an academic manner. They presented guidelines by which exhibit designers can work rather than describing the day-to-day experiences had in museum design.

Two main issues arose through analysis of the literature. The extant resources do not meet the needs of exhibition designers who are recruited to design after entering the field because 1) their focus is not on capacity building, and 2) they do not effectively address practical issues faced on a daily basis. Novice exhibit designers require support in their work. They need resources that build their capacity to design, as opposed to structuring the process for them or reporting findings from projects that have already been done. The current literature emphasizes these latter points and does not provide the support designers need to transition to this field.

This review directly addresses the practical experiences exhibit designers in their daily work in an effort to fill the gap in the literature created by its lack of emphasis on the aforementioned points. By extracting these points from the literature, this review will reveal what is known about exhibit design work, as well as areas about which more is needed to support exhibit designers. The findings in this article will make the design practices of exhibit designers more accessible and applicable to other practicing exhibit designers. The major themes that emerged from analysis of the literature indicate that exhibit designers collaborate on teams, refer to learning-based theories, follow process models, brainstorm, use visuals, and evaluate throughout the entire process. Each of these practices contribute uniquely to the design of exhibits and are the subjects around which the remainder of the article will be organized.

Table 2 indicates the number of articles that discussed each of these themes. Some of the articles mentioned multiple topics.

Table 2

Theme Frequency Across Articles

Collaboration	Learning Theories	Process Models	Brainstorming	Visuals	Evaluation
23	18	3	4	21	27

Collaboration

Exhibit designers generally work on teams to coordinate efforts for the completion of the exhibition (Lord & Lord, 2002; Carliner, 1998). Of the articles reviewed, 23 refer to the convention of design team collaboration. Because many of the articles did not provide explicit detail about design teams, further understanding of this practice was gained through referring to design manuals.

On a museum design team, each member has a specific role with associated responsibilities, which allows the team to function properly and accomplish all necessary tasks (Bogle, 2013). Exhibit design teams are often characterized by core project teams and peripheral members who help as needed. The team can also collaborate with others outside the team. For the project to run smoothly, each team member should be creative and have the ability to visualize design concepts, work with others, and maintain the exhibition program (Bogle, 2013).

Dedicated project teams. Museum design teams and the roles they should include are defined and described uniquely in different settings. For instance, Carliner (1998) suggested that exhibit design teams usually consist of a core group and peripheral members who lend support and insight as needed. The core team is composed of the idea generator (selects the concept for

the exhibition), the curator (subject matter expert), the implementer (makes sure the plan is implemented smoothly), and the designer (prepares the physical design of the exhibition) (Carliner, 2001). This team is responsible for designing, developing, and installing exhibitions (Carliner, 2000).

The *Manual of Museum Planning* described project teams differently than Carliner's model. It says project teams should consist of about six people for optimum performance, but teams can function with fewer people. Members of the project team may include the following: director/curator, researcher/scriptwriter, designer, finance manager, marketing manager, external specialists, and conservator. While this manual does mention the need for interdisciplinary perspectives, it does not describe how these teams function and how the unique contributions of each member work together in the design of exhibits. It merely states that the team is responsible for managing progress, and individual members should help with chairing the project team, convening meetings, and taking minutes. They can collaborate with other museum staff at various stages in the project, and in small or underfunded museums, multiple roles can be filled by individuals (Bogle, 2013), but it is essential for there to be a dedicated museum project team (Lord & Lord, 2001).

Peripheral team members. In most museum settings, a dedicated museum exhibits team can still ensure that basic tasks are accomplished. However, at times it is essential to recruit professionals from other fields to enhance the design. Peripheral team members have skills that are usually only needed part-time, so they also work on other projects during exhibit development (Carliner, 2000). These members include educators, production personnel, and editors (Carliner, 2001). Designers often work with researchers to develop and evaluate exhibitions (Callanan, 2012). Another example of collaboration with peripheral team members

is found in handling the tension of meeting visitor needs while remaining true to their institutional missions. To do so, a team of specialists from different areas, such as informal learning, content specialists, marketers, technical experts, and exhibit developers convenes to discuss how to fulfill both requirements (Skramstad, 2007).

These peripheral team members may or may not be employed at the museum. Many museums have staff who can fulfill these roles; yet on occasion, external designers may be hired either to contribute to design teams or to complete the design process for the museum.

University-museum partnerships. When discussing collaboration, many of the articles also talked about partnerships between universities and museums (Ashton et al., 2011; Brennan, 2014; Callanan, 2012; Couture, 2006; Hakkarainen, 2009; Hall & Bannon, 2006;; Louw, Ansari, Bartley, & Sanford, 2013). These partnerships are mutually beneficial: university researchers have opportunities to perform research and museums are provided with findings that augment their designs (Flagg, 1990; Louw et al., 2013; MacLeod, Dodd, & Duncan, 2015).

Critique. The articles reviewed provided only a basic description of the structure of design teams and the roles each team member fills. They do not discuss the specific tasks that need to be fulfilled by each individual, and therefore do not provide practical insights that can be applied by exhibit designers. Exhibit design manuals offer more detail about tasks to be completed. For instance, *Manual of Museum Exhibitions* details the responsibilities to be filled by the project director, specific attributes this person should have, and general guidelines about forms and templates to use. While it is helpful to read about this information, more concrete guidance is needed regarding how to think about issues and make decisions in these roles. Merely reading about responsibilities and attributes is not a capacity-building activity for exhibit designers. Greater support is necessary for them to be successful.

With regards to the practice of collaboration, there is little evidence that the practice is efficacious. Museums bring together armies of specialists from informal learning, content specialists, marketers, and technical experts for the development of innovative exhibits. Yet there is no formula for success or greatness, and it is hard to say that these efforts have resulted in better more imaginative exhibitions. Designers are left with the “fundamental dilemma of how to create exhibition that have a clarity of intent and focus and yet connect and engage with visitors who have a variety of motives for being in the exhibition” (Skramstad, 2007, p. 610). According to this source, interdisciplinary collaboration has its limits. This practice alone will not ensure an exhibition’s success.

Consulting Learning Theories

Planning for and supporting the learning experiences visitors have in museums is a high priority for museum designers. The importance of this topic is evidenced by the dedication of two entire issues of *Exhibition* to how patrons learn from museum visits and the implications for exhibit design (Ansbacher, 1999; Ansbacher, 2013; Hein, 1999; Rounds, 1999; Samis & Michaelson, 2013; Silverman, 1999; Snider, 2013). In collaboration with museum educators who demonstrate knowledge of educational theories (Nelson, 2015), exhibit designers refer to learning theories to plan informal learning experiences for visitors. Such theories provide a framework through which to consider the desired outcomes of a museum visit and then structure the design of the exhibit and visitor experience in a way that leads to these results. Learning theories used by exhibit designers were discussed in 18 articles. Specific examples include universal design for learning, experience-based learning, and the contextual learning model. These learning theories provide concepts with which to think, but do not structure the actual design process.

Universal design for learning. This learning theory was developed in the early 1990s as a way of accommodating individuals with disabilities. The framework is inspired by the universal design concept in architecture and derives from the learning sciences, reflecting the belief that variability in learning is not the exception, but the rule. This approach focuses on designing, creating, and studying learning environments that are accessible to as many people as possible. To do so, Universal Design for Learning suggests having multiple means of representation, expression, action, and engagement (Rappolt-Schlichtmann & Daley, 2013).

This framework can be used when considering many aspects of exhibit design. For instance, labels are meant to communicate information to visitors, but can be inaccessible to people with dyslexic-like characteristics, the elderly, children, and even those visitors whose goals are incompatible with reading all of the text (Rappolt-Schlichtmann & Daley, 2013). Thus, text labels should not be the only way of communicating information to visitors. It can be useful to identify a range of goals for museum visitors rather than assuming that all visitors have the same goal. This can be done through creating personas that reflect museum visitors and considering what they would do in the exhibition (Ashton et al., 2011). This practice would make the exhibition more accessible to a greater majority of patrons (Rappolt-Schlichtmann & Daley, 2013).

Experience-based learning. Another learning theory considered by exhibit designers is experience-based learning (Cohen, 1987; Harvey, 2014). The tenets of experience-based learning can be traced to John Dewey. The model divides the universe into two parts: the mind and the physical world, connected by the interface between them, which consists of the five senses (Ansbacher, 2013). Learning is constituted by the interactions of these three elements, and it is through the interactions of these elements that people make meaning. Museum

designers often use this theory when they consider learning in exhibits as making meaning (Ansbacher, 2013; Silverman, 1999). Some individuals design on the premise that meanings and understandings all exist in the visitors' minds. These designers recognize that the only thing they have control over is the physical environment in the exhibit. Using this theory helps them consider how people will perceive and make meaning from the exhibits with which they interact.

When using this framework, designers ask questions like “What do we mean by meaning? What are visitors making meaning about? Is meaning-making an esoteric or everyday activity? Is meaning-making a personal or social activity? Do we really need to do anything about it?” It may lead to recasting the inquiry cycle as a two-step sequence: (1) visitor + exhibit → experience, (2) visitor + experience → outcome. Contemplating the visitor experience in this way helps exhibit designers connect exhibits to expected outcomes, including patron learning. A focus on patron learning and meaning making has been a trend in the museum field since the 1990s (Hein, 1999; Rounds, 1999; Silverman, 1999) and some believe that “meaning making, seen as a manifestation of experience-based learning, will continue to guide exhibition development in the future” (Ansbacher, 2013, p. 19).

Contextual model of learning. Museum educators John Falk and Lynn Dierking referred to constructivist, cognitive, and sociocultural learning theories to develop what they call the Contextual Model of Learning (Falk & Dierking, 2000). This theory suggests that learning is an ongoing dialogue between a person and the physical and sociocultural environment, a “contextually driven effort to make meaning in order to survive and prosper within the world” (Falk & Storksdieck, 2005, p. 745). Meaning is derived through the interactions between the dynamic personal, sociocultural, and physical contexts of each individual.

Falk and Storksdieck identified 12 factors across these three contexts that contribute to the quality of museum experiences. These factors include 1) visit motivation and expectations, 2) prior knowledge, 3) prior experiences, 4) prior interests, 5) choice and control, 6) within group social mediation, 7) mediation by others outside the immediate social group, 8) advance organizers, 9) orientation to the physical space, 10) architecture and large-scale environment, 11) design and exposure to exhibits and programs, and 12) subsequent reinforcing events and experiences outside the museum. They studied these factors to determine how strongly each influences the learning that takes place in museums. Such data would help with designing exhibits and experiences, but the researchers still struggle to validly and reliably operationalize and measure each of the factors (Falk & Storksdieck, 2005).

Critique. There are several issues with referring to learning theories during exhibit design. First, while it is useful to consider how people learn, it can be difficult to attribute learning to specific factors or identify the impact that each factor has, as evidenced by the Contextual Learning Model example (Falk & Storksdieck, 2005). Second, museum educators are generally the ones trained in these theories. Studies show that the museum education staff know the most about what works for patrons educationally, but are rarely consulted on these matters (Rogers & Edwards, 2002). This lack of collaboration makes it difficult to actually apply learning theories in exhibit design. Lastly, learning theories provide guiding principles that can be useful to consider when designing. However, they are applicable for imagining the visitor experiences and making some decisions, not for structuring the entire design process. They do not describe each task that must be accomplished for planning, construction, and installation. For this structure, designers look to process models.

Following Process Models

The practice of following process models is helpful because design can be a complex process with many moving parts. Process models guide designers through the entire experience. The exhibit design process is discussed in only three articles; further description is found in several museum design books such as *The Manual of Museum Planning*, *The Manual of Museum Exhibitions*, *Museum Exhibition Planning and Design*, and *Exhibition Planning and Management*. These manuals include many variations of process models, but in general, the models can be described as the checklist model, phases model, design thinking model, design choices model, and guiding principles model.

Checklist model. The notion that “the complete checklist is at the core of a successful exhibition” (Buck & Gilmore, 2003, p. 13) accurately describes the approach of many museum designer manuals. Exhibit designers often follow a checklist model to ensure they cover all of the necessary steps and do not miss important details. For instance, *On the Road Again: Developing and Managing Traveling Exhibitions* presents checklists for each person involved in the creation of an exhibition. It says the curator should “(1) determine which permanent collection objects will be in the exhibition, (2) develop label information for checklist, and (3) forward list to registrar and conservator for review” (Buck & Gilmore, 2003, p. 13). Books such as this one describe the whole process and all the considerations that must be made for exhibition design. Such considerations include tasks and issues like color, lighting, and conservation (Bogle, 2013). They tend to be more focused on quality management than on the creative aspect of the design process. In some cases, the checklist model is used in conjunction with the phases model as a way of delineating what needs to be done during each phase (Bogle, 2013; Klein, 1986)

Checklists do provide a potentially useful approach to exhibit design, but they also have many flaws and associated risks. Manuals that take a regimented checklist approach set an outside standard for what is expected in museum work and are designed to reinforce the guidance that comes from others in the museum field, along with previous experience (Bogle, 2013). But if pre-established patterns are all that designers are taught, they will have no training in thinking innovatively and thus will be ill-prepared to help the field progress.

Such an approach does not foster creativity; rather, it reinforces the status quo. By maintaining old patterns, “museums are taking three steps forward and two steps back as they struggle with really hard, entrenched problems” (Norris & Tisdale, 2013, p. 12). The manuals that include checklists are written for museum professionals who are involved in a variety of museum-related tasks and who could be at any stage of their careers. They provide a comprehensive overview of tasks to be accomplished but do little to encourage or foster creativity. Creativity is domain specific, so professionals must have an understanding of the conventions of their field in order to be creative within it (Sawyer, 2013). In this sense, checklists could be a beneficial resource for new museum professionals who are just becoming familiar with the field. However, utilizing checklists is detrimental to more seasoned individuals who blindly follow a pre-determined list of tasks. By adhering to checklists, exhibit designers are, in a sense, abdicating their creativity in favor of comfortable extant routines. Additionally, checklists rarely explain “the why” behind the tasks they set forth. They free designers from having to think critically about their work and the problems they are trying to solve, and thus may preclude significant progress in the field.

Another drawback of checklists is that they do not provide room for flexibility and adaptation. One manual claims that it will be easier to assess, market, prepare and travel an

exhibition if the checklist is completed early and changes minimally (Buck & Gillmore, 2003). While this statement may be true, using a checklist could make it harder to assess the needs of a given exhibit design process and the team members involved. A checklist mindset also largely prevents failure from occurring, thus robbing designers of the opportunity to learn from their mistakes, a significant contributor to creativity (Norris & Tisdale, 2013). Creativity does not occur in a single moment; it results from long periods of hard work and is often the aggregate of mini-insights discovered over time (Sawyer, 2013). Checklists could prevent the aggregation of these insights if the focus is on the completion of tasks rather than the formulation of ideas.

Phases model. A second model exhibit designers use is the phases model. Because many designers conceive of exhibition development as sequential in nature, they follow models that outline activities and tasks required in each phase.

Many design manuals follow a phases approach to design (Bogle, 2013; Dean, 1994; Lord & Lord, 2001; Lord & Lord, 2002). A representative example of such an approach is found in *Museum Exhibition Planning and Design* (Bogle, 2013). It presents a phase-by-phase method for professional exhibit planners to consider as they develop a project, along with an overview and work schedule for each phase (Bogle, 2013). This manual includes different stages in the planning and designing process and suggests timelines for each of these stages. These stages include pre-exhibit planning and designing, exhibit planning and designing, and post-exhibit planning and designing. In the pre-exhibit planning stage, feasibility studies are performed, and a master plan is created. Subsequently, several factors are considered during the exhibit planning and designing stage, including schematic and bidding issues. The theme for the exhibit is selected, exhibit elements are studied and refined, and all design issues must be resolved. In the post-exhibit planning and designing stage, the exhibit is constructed, installed, and maintained.

While manuals such as these provide useful frameworks for structuring and completing design work, they are not a panacea. Strict adherence to them does not ensure the success of an exhibition. The manuals that discuss phases tend to present ideas about what to do, but not how to think about important issues. For instance, *Exhibitions Concept, Planning, and Design* offers guidance about creating interactive exhibitions:

They...must go beyond pushing “start” buttons and viewing scripted presentations.

They, like all interpretive methods, should utilize the museum’s resources and authority to engage visitors in inquiry and critical thinking. When they are developed to be multisensory and hands-on they engage the visitor in a participatory learning experience—one that is varied and that provides physical, intellectual, and sensory involvement. (Klobe, 2012, p. 52)

The author provides general principles in this excerpt, but does little to describe how to think about engaging visitors in inquiry and critical thinking. In a sense, suggestions like this can be sterile. They do little to help build the creative capacity of the designer, but instead act as a roadmap to structure the creative journey.

The way the phases model is presented in exhibition books gives the impression that it is a representation of reality. If the model is taken too literally, where each phase is separate and distinct, it can lead exhibit designers to miss out on opportunities for creativity at junctures where the phases might overlap. Though having some structure and direction may be useful, it may hinder the creativity of designers if they follow the phases too rigidly and do not consider other issues that may be at play or implement other approaches that may also be useful.

Design thinking model. Regardless of the specific design approach followed, at the beginning of a new project, ideation must take place in order to develop a theme for the

exhibition (Klobe, 2012). The checklist and phases models provide little explanation of the process of developing and selecting ideas. More detail about this experience is provided in the design thinking model. The process generally includes inspiration, ideation, and implementation (Brown & Wyatt, 2015).

In recent years, some aspects of design thinking have been applied to museums in order to create exhibits that are better tailored to visitor needs. In *Creativity in Museum Practice*, Norris and Tisdale introduce components of the ideating process, including preparation, incubation, insight, evaluation, and elaboration. Ideation includes a divergent phase in which many ideas are proposed, and a subsequent convergent phase in which ideas are considered and a few are selected for development (Norris & Tisdale, 2013).

After the designers agree on a selection of ideas, prototypes are created as a way of testing the concept, obtaining feedback, and furthering the design process. The prototypes can take a variety of forms, including storyboards, bodystorming, virtual simulations, enacting, or proxy objects (Milligan & Rogers, 2006). Designers learn from the mistakes they make on prototypes and the feedback they receive about their prototypes, which then leads to improved designs. This is an iterative process that continues until they reach a product that will accomplish the desired results.

The design thinking model supports creativity in exhibit design more effectively than the aforementioned models do. It sets a different standard for success by focusing on the development of ideas rather than completing tasks. This model allows for a more fluid connection between projects because ideas that arise during the design process, but that are not selected for use, can influence future design projects. The ideas continue to inform discussion

between exhibit team members. In the checklist and phases model, there is less room for discussion, so fewer ideas emerge that can be used in the future.

The skills required by design thinking can be an effective way of testing ideas and obtaining feedback for the development of an exhibition. Design thinking is a useful approach for exhibit designers to have in their arsenal, but as an inclusive design model, it is also lacking. The design thinking model is not a project management tool. It does not consider administrative factors, nor does it necessarily account for specific design details that must be considered, such as color and lighting.

Additionally, there are no exhibition design manuals that talk directly about design thinking. Some of the manuals, like *Creativity in Museum Practice*, discuss elements of design thinking, but none present the body of principles of design thinking as they pertain to exhibit design specifically. It is more common for design thinking to be discussed in blogs such as *Design Thinking for Museums*, *This is Design Thinking*, and *Art Museum Teaching*, or in journal articles (MacLeod et al., 2015). However, journal articles are often inaccessible to museum professionals, either because they do not have access to the journal itself, or because the articles are written in an esoteric manner. Thus far, only a few pioneering museums, such as the National Design Museum, have adopted design thinking methods. Otherwise, it has not yet had a widespread impact on the practices and design culture of museums (Silvers, Wilson, & Rogers, 2013).

Design choices and guiding principles models. Saul Carliner studied museum exhibit design from an instructional design perspective to determine what instructional designers could learn from exhibit designers. After studying exhibit designers, he explained that they “described

more than a series of events; they described a sequence of choices” (Carliner, 1998, p. 76).

These choices are presented in the two models he proposed.

The first model that Carliner (1998) developed from his interviews describes the choices designers made and includes four elements: design goals, design resources, design techniques, and constraints. Design goals represent the principles designers hope to achieve through their decision process and that must be accomplished before the task is considered complete. Design resources include physical and intellectual materials available to designers. Design techniques are the strategies for achieving the goals using the available resources. Constraints are the outside influences that limit how the resources and strategies are used to achieve a goal. The other models described in exhibition design manuals could fit in Carliner’s design techniques category.

The second model (2001) he developed details guiding concepts that exhibit designers use in their work. These concepts are immersion, themes, layering, and skimmability. Carliner suggested that an exhibition should immerse visitors in a story and should divide complex topics into themes. The content in each exhibition should be layered so visitors need not read every label to experience the exhibition. Lastly, labels should be written so they can be skimmed while standing, which offers more flexibility to visitors.

Carliner presented unique ideas about exhibit design that in some ways look at the process more holistically than other exhibit design models. However, his models were not written for exhibit designers. They were published in *Performance Improvement Quarterly* and *Technical Communication*, both of which are journals that exhibit designers will likely not read. Additionally, his principles are so vague that they are characteristic of the recommendations Mortensen critiqued when she said the principles derived from research are articulated at a level

of generality that makes them difficult to refute and that does not account for the specific design context (Mortensen, 2010).

Critique. Each individual model has strengths and weaknesses described in the corresponding sections. Generally speaking, while the models described in the literature are useful for presenting a series of stages or choices that should be considered during the design process, they do not discuss the actual experiences designers have while they are planning and building exhibitions. They do nothing to identify the needs of designers. Design is a creative process that often involves the collaboration of multiple people. Understanding how the process transpires in reality would enable designers to find ways of improving the experience. Being able to navigate between models and gain access to other supportive resources would assist designers in meeting the high expectations placed on them for exhibition development.

Brainstorming

Some of the process models previously mentioned describe the practice of brainstorming, a common technique used by museum professionals in the process of developing new exhibits (Hein, 1990; Klobe, 2012; Norris & Tisdale, 2013). Brainstorming is often done early on to develop ideas ranging from the overall exhibition idea to interactive components that engage visitors (Ashton, et. al, 2011). Four articles in the selected literature discussed this activity, and further insight was gained through exhibit design manuals. This process shows up in various ways in the museum field, including formal museum training, sessions in museum conferences, the work of design teams, and as a strategy for increasing community involvement.

Formal training. Students who receive training in museum studies as part of their formal education are likely to be exposed to brainstorming. In several museum studies graduate programs in the United States, students are expected to participate in brainstorming exercises

(Brown & Austin, 2014). At George Washington University, students collaborate with designers from other disciplines to interpret the museum's collections as they create a unique experience for the public. Graduate students in the University of the Arts MFA Exhibition Planning and Design program participate in design charrettes twice a year in which a real-world problem is posed by an outside client (museum or curator). In these charrettes, the students brainstorm and problem solve for 24 hours and then present their ideas to the client (Brennan, 2014).

Museum conferences. Brainstorming also can be found in training given in museum conferences. A session entitled *Beyond Brainstorming: Leadership Approaches for Innovation and Creativity* was presented at the American Alliance of Museums in 2012. The presenters led the audience in a brainstorming activity in which they listed all the museum rules they could think of and then brainstormed ways these rules could be broken strategically (Norris & Tisdale, 2013). Likewise, a session at the Utah Museum Association 2016 conference discussed rules of brainstorming found in *The Art of Innovation* by Tom Kelley, general manager of IDEO. Participants were encouraged to understand and define the problem well before beginning to ideate, and then were given an opportunity to participate in a group brainstorming experience about a museum design challenge to practice incorporating the rules into the experience (Ashton & Wigdahl, 2016).

Exhibition development. Development of exhibit components often begins with brainstorming by exhibit designers and museum staff (Dristas & Borun, 1997; Wakkary, 2005). While brainstorming may lead directly to prototyping and the construction of exhibit displays, on other occasions the process may be more circuitous and iterative. Students in a design class at Brigham Young University collaborated with Thanksgiving Point, a nearby venue with several museums on the complex, to develop an exhibition that connected the topics of light and space in

an effort to receive a NASA grant which would fund the exhibition. During brainstorming sessions, students took turns drawing their ideas on the whiteboard and explaining the concept to the class. No critiquing took place during this time. Other students built on the ideas shared and the hour-long sessions often generated upwards of 75 ideas. Because the students were not scientists by trade, they performed extra research about light and space exploration, which they shared, along with their ideas, during brainstorming sessions. This eventually became a brainstorm-research cycle that informed the entire design project. Ultimately, Thanksgiving Point received the grant, and the NASA Blast exhibition ran from July 2010 to June 2011 (Ashton, et al., 2011).

Community involvement. Many museums also involve community members in the brainstorming process to ensure their designs are aligned with patrons' interests. Through including community members in brainstorming and prototyping activities, designers are able to obtain and integrate feedback from visitors (Klobe, 2012; Lord & Lord, 200).

One such example is the Museum of Mölndal in Sweden, which collaborates with organizations such as eldercare and schools to develop educational programs (Ciasnocha, Olsson, & Shermis, 2006). At the beginning of a new project several years ago, it endeavored to interview the locals about their political identity as inspiration for a new museum exhibition. However, they found that people wanted to talk about the mundane activities of everyday life, which provided insight into the true identity of the city and its inhabitants. The focus of the exhibit designers shifted from politics to showcasing aspects of daily life. Community members were invited to donate old objects that represented their lives, which were then put on display.

The result was a miraculous exhibition that helped locals feel like they were part of the museum's work and prompted visitors to tell stories from their lives as they experienced the

exhibits. It changed the design approach of the museum staff from having a predetermined purpose for the exhibition to being more open to input from the community. This shift occurred based on what was learned from the locals as they were interviewed.

While incorporating ideas from community members can be beneficial, designers must still maintain decision-making authority. If they base designs solely on input from community members, the results could be disastrous. Designers at the High Tech Museum based many of their design decisions for the Network Earth exhibition on feedback from visitors. Eventually the technology presented in Network Earth became widely available, and the exhibition presented nothing unique. Visitor attendance declined, and ultimately the museum closed (Carliner, 2000). This example serves to illustrate a potential risk of focusing too heavily on community input during concept development.

Critique. Brainstorming is not a panacea. There are several issues that can arise with brainstorming sessions, including production blocking, evaluation apprehension, social loafing, matching, motivation, and insufficient time for idea incubation (Norris & Tisdale, 2013). Having techniques such as brainstorming upon which to draw will help designers in their design process, but will not ensure a creative product.

Performing Evaluation

Evaluation is a very important practice for museum designers and 27 of the reviewed articles discussed findings from evaluation projects that had been done in museums. Museum designers use several types of evaluation in their work. Front-end and formative evaluation are useful when testing assumptions and experimenting with different versions of prototypes that represent possible exhibits. Summative evaluation is performed to determine how successfully

an exhibition meets its objectives. Visitor studies help designers be attuned to the needs and expectations of museum patrons.

Front-end and formative evaluation. These forms of evaluation play a significant part in the museum exhibit design process. Front-end evaluation is done to test assumptions about visitors (Falk, 1997). More specifically, it can assess the audience's preferences, interests, knowledge, misconceptions, and attitudes (Bitgood, 2002). Designers at the Carnegie Museum of Natural History in Pennsylvania wanted to display images of ancient petroglyphs discovered in the Saudi Arabian desert. They hoped to engage visitors in museum research and collections, allow audiences to observe the petroglyph site, and support visitors in their personal sense-making experience. To do so, they performed a front-end user study and combined it with social science-based frameworks and theories to develop solutions. Ultimately, they created an explorable image viewer with all components stored locally on the kiosk computer (Louw et al., 2013).

Formative evaluation is most often used to test specific designs with audiences to modify them for the final design (Bitgood, 2002; Serrell, Sikora, & Adams, 2013). In practice, this is done when designers create test exhibits and prototypes and use them to obtain feedback from visitors about how to improve the design. Multiple iterations help designers determine what does and does not work (Dristas & Borun, 1997). For instance, at its inception, the Exploratorium in San Francisco prototyped exhibits and displayed them for three months or longer. During that time they observed visitors to determine which parts of the exhibit were frustrating or confusing (Hein, 1990). This practice can help designers refine extant designs or develop completely new ideas (Norris & Tisdale, 2013).

Research has shown that conducting formative evaluation can help designers produce better exhibits. For example, museum staff from multiple Philadelphia museums attended a workshop to learn evaluation skills. With their new abilities, they brainstormed and prototyped exhibit ideas. Throughout the prototyping process, they tested the designs with visitors to ensure the prototypes were meeting their content goals and were conducive to family learning. The exercise in formative evaluation was useful in determining what did and did not work and ensuring that prototypes met their goals (Dristas & Borun, 1997).

As this example demonstrates, getting visitor feedback helps designers develop effective designs. Designers understand that “part of the prototyping is learning from the failed parts” (Norris & Tisdale, 2013, p. 127). Determining things that are confusing or do not work well is just as important as knowing what does work well. With this knowledge, designers can make improved versions of the prototype and present them to the audience for further feedback (Norris & Tisdale, 2013). Such front-end and formative evaluation can also ensure that exhibits help patrons fulfill their personal agendas for visiting the museum and provide “experiences that meet a wide range of interests and expectations” (Wolf & Wood, 2012, p. 5).

Summative evaluation. Summative evaluation is performed to ascertain to what degree a project met its objectives. This process can reveal strengths of a project, as well as areas of improvement. It can also bring to light unanticipated insights that can be used to enhance museum work in the future. For instance, designers at the Marine Biology Museum performed a summative evaluation to understand the experiences visitors had in the Basking Shark Hall. The staff administered a questionnaire at three separate points in time: once before the patrons’ visit to the Basking Shark Hall, once immediately after, and again three months after the visit. The evaluation indicated that people had little prior knowledge of the subject matter, that men and

women have different learning behaviors, and that receptivity to the material is correlated with age. The data they collected will be used in developing strategies for didactic proposals in the future (Miglietta, Belmonte, & Boero, 2008). Since findings from the survey could be relevant to other exhibit subject matter as well, this example demonstrates how summative evaluation can reveal insights that can be used to enhance exhibits in the future.

Visitor studies. Museum professionals can create better exhibits and experiences by performing visitor studies to ascertain how patrons will respond to the exhibits. Such studies are done when an exhibit is completed and is open to the public. In his book on visitor studies, Harlow (2015) explained,

Strategically designed audience research can remove a lot of the guesswork that comes with creating and fine-tuning programs to attract new visitors. It can stimulate ideas about how to make an institution and its art more accessible to newcomers, identify obstacles that are getting in the way of engagement, and suggest strategies for overcoming them. As an initiative unfolds, research can illuminate what's working, what's not, and why. (p. 1)

Although visitor studies can be used to develop greater clarity, they also have their limits. They may spark new ideas for solutions but will not remove any of the complexity of the situation. In terms of Patton's complexity matrix (see Figure 1), museums professionals do not have a high level of certainty about what to do, nor do they always have a high level of agreement. This indicates that the situation is complex. Various efforts, including visitor studies, are done to place boundaries on the uncertainty and complexity to prevent it from reaching chaos. These efforts are a good preparation for the process of design. Yet no amount of preparation will remove all of the unpredictability that exists in the design process.

Complex situations

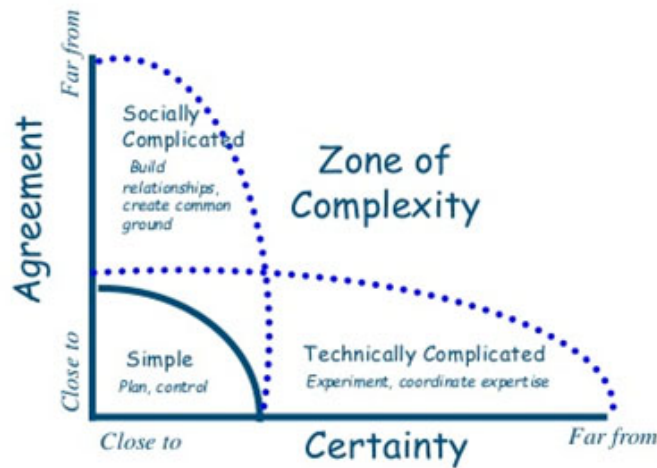


Figure 1. Patton's complexity matrix.

Critique. While evaluation can be an informative practice and museums aspire to do it regularly to gather information for their designs, it is seldom done to the extent it should be. Few museums have the resources necessary to maintain ongoing evaluation programs due to the high cost and time commitment required (Paris, 2000). In theory, museums value the use of quantitative evaluation data to generate design guidelines and evaluate effectiveness; in reality, other than attendance figures and public program evaluations, some rely almost exclusively on anecdotal evidence to evaluate their work (Carliner, 2001).

Using Visuals

Visuals of all sorts are used in exhibit design. Because they are so versatile, they can be used in many design settings: sketches shared in brainstorming meetings (Ashton, et. al, 2011), 3D models for determining space planning and traffic flow (Klobe, 2012), prototyping to test interactive components (Hein, 1990), and communicating plans to production personnel and fabricators (Carliner, 1998). This section will discuss how exhibit designers use sketches,

storyboards, models, and prototypes. At least one of these visual types was mentioned in 21 of the articles reviewed.

Sketches. Exhibit designers use sketches to embody abstract ideas (Rodgers, Green, & McGown, 2000) and communicate them to others (Tovey, Porter, & Newman, 2003). They are often used in early stages of the design process to first explore and then refine elements such as appearance, traffic flow, and methods of exhibit (Klein, 1986). Returning to the NASA Blast example at Thanksgiving Point, the team members drew their ideas on the white board along with a few key words to describe their ideas to the class. Later, other class members could modify the pictures or add their own ideas in pictures to the extant ideas (Ashton, 2011). Likewise, at the Canadian Nature Museum, designers were encouraged to consider potential scenarios that might take place in an exhibit and document them in sketches, storyboards, role-playing videos, and interactive works (Wakkary, 2005). As is demonstrated by these examples, sketches help designers visualize the problem (Tovey, et al., 2003) and manipulate relevant ideas (Purcell, 1998).

Storyboards. Once specific ideas have been selected for development, they are often recorded in storyboard form. Storyboards are an effective way of considering scenarios visitors might experience (Wakkary, 2005) and what a visitor will actually see in the exhibit (Stavast, Inkley, & White, 2014). At this teaching museum, students are taught to use storyboards in exhibit development. Through storyboards, student designers can visualize the final product, see potential problems, and experiment with ideas throughout the life of the design process. Storyboards can be easily modified to change the design as necessary. Because of this teaching method, students are better able to visualize the visitor experience and craft a stronger dialogue

between the visitor and the text, objects, and physical space of the exhibition (Stavast et al., 2014).

Models. Scale models help determine traffic flow, inform space planning, warn of potential areas of visual discord or monotony, and save hours of time trying to accommodate designs later (Klobe, 2012). They are often created out of paper, cardboard, and foam core, but can also be more elaborate and detailed, depending on the scope and size of the project (Klein, 1986).

Models can also help designers develop a shared vision for the exhibition (Ashton et al., 2011). The class that worked on the NASA Blast exhibition used a 3D model to assist in this process. After several iterations of brainstorming and discussing ideas, they realized they needed a better understanding of the physical space in the gallery. They created a scale model prototype of the room and included scale models of people and exhibits to get a sense of how things would fit in the space. One student remarked, “I believed having a 3-D model would not make it any easier to create the design than using a traditional blueprint. However, it helped me visualize the room much easier. And the easier you can imagine the space with your design, the more you can do” (Ashton et al., 2011, p. 64).

Prototypes. Prototypes enliven ideas and help teams determine how to fulfill the tasks and meet the requirements that are established for a given project (Smith, 2013). Communication is facilitated through prototypes because they offer a shared view of the design with which people can interact (Yang, 2005). They also help designers overcome tensions because they are a tool with which designers can negotiate different contexts and backgrounds from which they operate (Jornet & Steier, 2015).

Prototyping also supports the development of creative confidence. Exhibit designers at Boston's Museum of Science used prototypes to prepare for a new Pixar exhibition. A designer on the project explained "the physicality of prototyping also inspired my creativity. . . It was okay if I messed it up; I was supposed to mess it up. Otherwise, how would I know if something really worked?" (Norris & Tisdale, 2013, p. 129). As this example illustrates, prototyping allows exhibit designers to assume an attitude of experimentation, which makes it okay to fail. This decreased pressure for perfection allows designers to explore many ideas, allowing creativity to flow.

Critique. The literature provides plenty of examples of how exhibit designers use visuals in their work. What it does not describe is how designers select which visual is best suited for a specific task. There is no description of the strengths and weaknesses of each visual type, or how multiple visual types are used in conjunction or in succession during a design project. Further guidance in this area is needed for designers to make informed, purposeful decisions about their use of visuals.

Conclusion

In this paper, we reviewed literature on museum exhibit design to clearly answer the question, "What is the creative design process of exhibit design teams?" We found very little explicit description of the design practices of these teams. A rare exception, *From Takeoff to Landing: Looking at the Design Process for the Development of NASA Blast at Thanksgiving Point*, detailed the experiences of a team of students who collaborated with Thanksgiving Point to design a new exhibition that ultimately was funded by a NASA grant. The article explains how the project was chosen, the creation of an evaluation plan, the brainstorm-research cycle,

efforts to obtain a shared vision, details about the design, and finally the implementation and evaluation of the project (Ashton et al., 2011).

Other articles touched on design practices. Core design team members collaborate with peripheral team members and form university partnerships to enhance their designs. They refer to learning theories as they plan the experiences museum patrons will have during their visit to ensure the visits are educational. Process models are used to structure the design process and ensure that all essential tasks are completed. Designers brainstorm in order to develop ideas for the exhibition. To test the efficacy of these ideas, and to ensure they are meeting their objectives, they also perform evaluations throughout the life of the project. The practice of using visuals can be used in some types of evaluation, as well as for communicating ideas and plans with those involved.

At a basic level, this review can help designers who have not received formal training in exhibit design to become more familiar with the practices of their colleagues and offer suggestions of new techniques to implement. However, the extant literature provides little in terms of teaching exhibit designers how to perform these activities. It does not provide detail about how decisions are to be made. Further documentation of the exhibit design process and the practical details of fulfilling these responsibilities is needed to support designers who have not received formal training in these issues.

Of greater importance, this review serves as a call to action. Because of the high demands on exhibit designers and the paucity of detailed support for their day-to-day activities in the literature, further research must be done on the experience of individual designers. Findings would reveal more about the daily experiences of exhibit design and how they perform the practices discussed in the literature. Such results would lead to specific, actionable guidelines

and serve a capacity building function that current literature does not fill. Guiding principles that ease the transition to the exhibit design field will support the effectiveness of inexperienced designers in creating innovative exhibits.

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ARTICLE 2

“Picture This”: The Use of Visual Representations in Museum Exhibit Design

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Abstract

Visual representations of ideas, such as sketches, storyboards, prototypes, and bodystorming represent practices which are frequently used in many design fields to explore ideas and elicit feedback. They also bring issues to the awareness of designers earlier in the process, allowing for timely consideration and resolution. One relevant, but unexplored, aspect of using these visual representations in design is how they affect communication between designers. This article will report on a qualitative study of museum seven exhibit designers that examines how visual representations are used in exhibit design and how these visuals facilitate the discussions during the design process that contribute to group creativity.

Keywords: visual representations, sketches, storyboards, prototypes, bodystorming, communication, group creativity

Introduction

It is standard practice to use visual representations of ideas, such as pictures, during the creative process in many design fields such as architecture (Bilda, Gero, & Purcell, 2006), film and cinematography (Teng, Cai, & Yu, 2014), and engineering (Perry & Sanderson, 1998). So meaningful is this skill, graphic design instructors insist that it is vital to “equip students with the ability to make well-informed decisions about tool choice and tool use during design ideation” (Stones & Cassidy, 2010, p. 439). Though graphic design is an inherently visual field, the use of visuals as tools has application in other design fields as well. For instance, extensive research demonstrates the usefulness of visuals in product development. They are a means of exploring problems and generating possible solutions. Visuals help designers understand specific design challenges and make inferences about the situation (Suwa & Tversky, 1997). They also contribute to many aspects of problem solving (Dorst & Cross, 2001; Do, Gross, Neiman, & Zimring, 2000). Research in cognitive psychology has established that the cognitive load of processing ideas is reduced for designers through the use of visuals. Furthermore, studies show it is easier for designers to process complex structures with visuals rather than relying on working memory without the additional support visuals provide (Cash, Stanković, & Štorga, 2014). Vicarious experiences are provided by visuals, which allows designers to glean and evaluate the pertinent information without investing as much time or effort into creating the experience (Menezes & Lawson, 2006). Visuals also can guide important design conversations “if they lead the team visually into a fruitful sequence of conversation steps” (Eppler & Kernbach, 2016, p. 96). Such discussions should help designers consider the sensory qualities of a design rather than just focusing on its visual appearance (Camere & Bordegoni, 2016).

What the literature does not mention is the integral part visuals play in how design teams collaborate. Visuals are construed to actually structure the collaborations that transpire because they represent the distributed cognition of design teams and how ideas are negotiated by team members (Henderson, 1998). Thus,

design cultures or styles are intrinsically tied to the way in which each constructs representations of their ideas. Such representations—sketches, drawings, prototypes—are the heart of design work and constitute the space in which ideas are defined, refined, and negotiated. (Henderson, 1998, p. 141)

A team's ability to create, interpret, and communicate with visuals can facilitate or restrict how they interact as a group, making visuals "primary players in the social construction of the design culture or design style of the designing group" (Henderson, 1998, p. 140). As Henderson indicated, visuals are a critical component of design cultures and have a significant influence on the work that is produced. They have an obvious connection to the products created, and a far subtler relationship to the designers themselves. While seemingly covert, the connection between designers and their visuals has a significant impact on their ability to develop greater expertise and collaborate on a team. However, most designers are unaware of how visuals influence their interactions, and therefore use them in ineffective ways that may slow or prevent their professional development and collaboration. Thus, it is essential that designers think deliberately about how they use visuals. The establishment of an effective design culture depends on it.

This paper reports on a case study of a museum design team and how they use visuals during the exhibit design process. The study looked at this aspect of material culture and how it affected the interactions between team members. The paper reports several themes that describe

elements of collaboration that may generally be overlooked when considering the use of visuals to design.

Literature Review

Extant literature describes how visuals are commonly used in design. For purposes of this article, and to delineate these forms of visual representations from each other, they will be defined as follows. Sketches are “rough drawings representing the chief features of an object or scene and often made as a preliminary study” (Sketches, n.d.). For an example of a sketch, see Figure 1. Storyboards are “a panel or series of panels on which a set of sketches is arranged depicting consecutively the important changes of scene and action in a series of shots” (Storyboards, n.d.). Prototypes are any three-dimensional representation of an idea that an audience and designer can manipulate and experience. Bodystorming is a method in which brainstorming is made physical. During bodystorming, role-playing and simulation with simple prototypes are done to create informative performances that illustrate what it might be like to use a product that is under development (Martin & Hanington, 2012).

Sketches

Because sketches are simple and easily created, they are used by designers in the automotive industry to develop new design concepts. Researchers studied six designers at the Ford design studio to understand the physical and mental processes these designers go through as they sketch. They compared the process of these professional designers to student designers to ascertain the differences between the two groups. Findings indicate that, when compared to novice designers, professionals have a greater understanding of physical dimension and use an iterative design approach in which they used sketches to facilitate problem solving and creative thought (Tovey, Porter, & Newman, 2003).

As illustrated by the automotive designers, sketches elucidate aspects of the parallel development of the designer and the product. Sketches allow designers to set out ideas spontaneously (Bilda et al., 2006; Segers, De Vries, & Achten, 2005) without investing much in terms of time (Rodgers, Green, & McGown, 2000; Stones & Cassidy, 2010) and money (McGown, Green, & Rodgers, 1998). Expert designers are more adept at using visuals, suggesting that visuals are often a part of their professional development (Bilda et al., 2006). These visuals also contribute significantly to the design process (Dörner, 1999; Jonson, 2005; Kavakli & Gero, 2001; Suwa & Tversky, 1997; Teng et al., 2014) and are said to be essential for conceptual designing (Bilda et al., 2006). Designers use sketches to focus their non-verbal thinking (Rodgers et al., 2000), consider the idea as both its component parts and as a whole (Bilda et al., 2006), and tap into the deeper meaning and implications of their ideas (Eppler & Kernbach, 2016). Sketching enlivens previously only imagined designs (Bilda et al., 2006; Tovey et al., 2003). Through sketching, designers can embody and explore ideas that are not fully developed (Rodgers et al., 2000), communicate the physical nature of an idea (McGown et al., 1998), and subsequently clarify its characteristics to determine what will and will not work (Dörner, 1999). All of these activities are critical in the product development process.

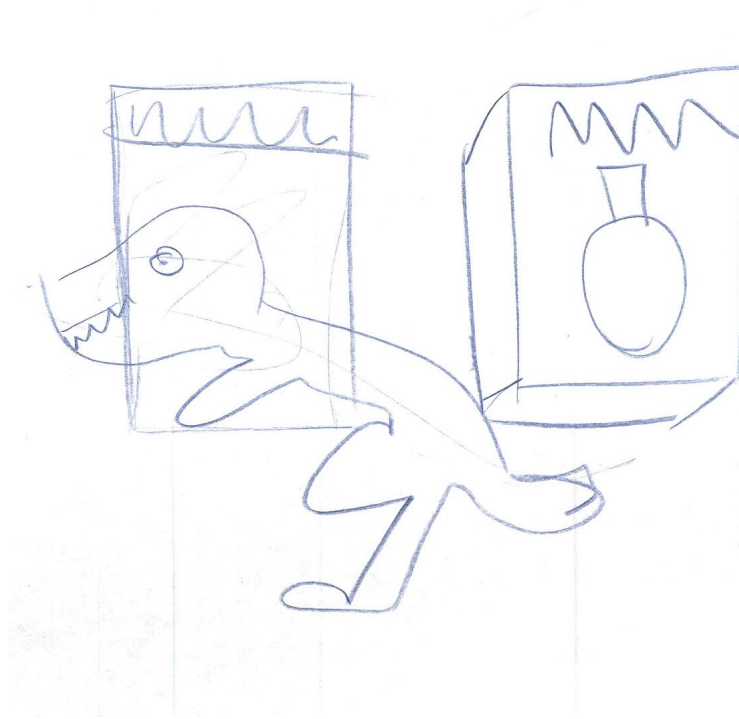


Figure 1. Sketch of exhibit design layout.

Storyboards

Another valuable visual for product development flows naturally from sketching. Sketch methods easily lead to the creation of storyboards because key ideas and images can be created and then organized in a storyboard sequence (Teng et al., 2014). Storyboards are an exploration, analysis, and conceptualization tool generally used later in the design process once ideas from sketches have been evaluated and selected for development. The development of storyboards often starts with a collection of individual drawings that represent single scenes, which are part of the whole design being drawn. Each separate depiction in the storyboard represents a specific scene or perspective. Taken together, they represent the sequence in which things will flow.

Storyboards are utilized in cinematography, live television, animation, and special effects to plan the details of how a story will be portrayed (Teng et al., 2014). In architecture, they are used to visualize presentations of projects by creating analog versions of proposed buildings that

will later be digitally designed (Cristiano, 2007). In other design contexts such as industrial design, storyboarding is a way of visually recording social, environmental, and technical factors that affect the context of how end users will interact with the product (Martin & Hanington, 2012). Storyboards were used by students at Georgia Institute of Technology in their industrial design classes. When working on a product development project to redesign travel luggage, students performed research about the needs of consumers as well as market standards as a basis for beginning their design project. After completing the research, students storyboarded their designs to show how luggage is handled through the whole travel experience from storage, packing, passing security, walking through the airport, boarding the airplane, loading it into the overhead bins, and ultimately back into storage. These storyboards facilitated discussions about various design features and how to prioritize them to meet user needs (Reeder, 2005b).

As this example demonstrates, storyboards can contribute to product development because they are drawn with the target audience in mind (Martin & Hanington, 2012) and visually describe how users will interact with the product. When designers examine design challenges in depth using storyboards, they can understand the complexity of the situation and consider individual portions of the situation while not losing sight of the whole (Reeder, 2005a). They can visually document how users will interact with the product and use this documentation to develop innovative product solutions that address the needs and expectations of users (Reeder, 2005a). In general, storyboards act as a visual budget, which helps the production process run more smoothly by planning and allocating resources effectively (Cristiano, 2007). Because nothing is fixed or unchangeable, storyboarding is a flexible way of trying out ideas and incorporating changes; ideas can easily evolve as they are drawn in storyboards (Glebas, 2013), as was the case with the exhibit pictured in Figure 2.

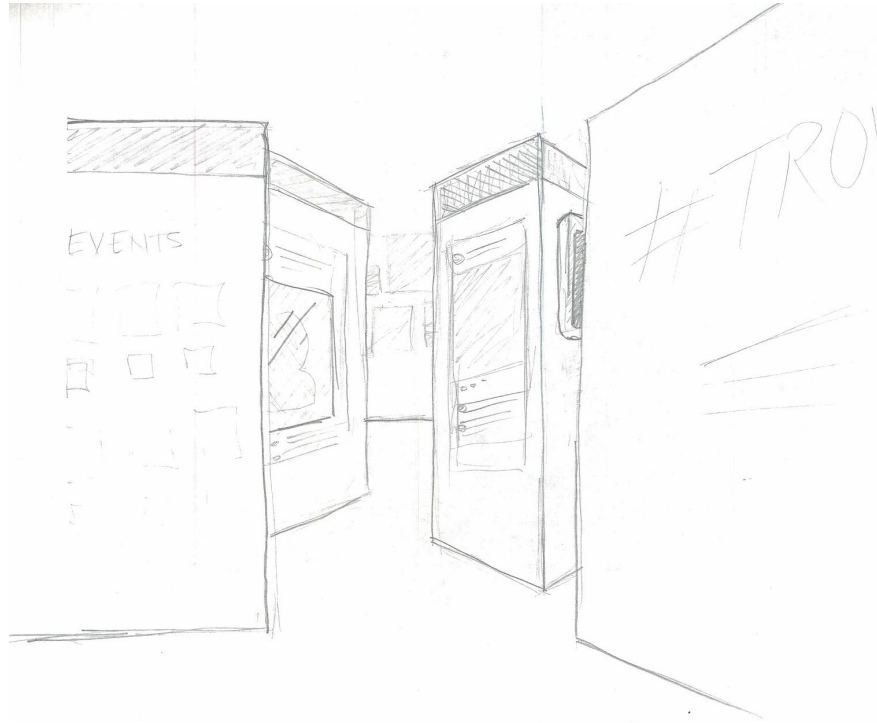


Figure 2. Storyboard of *Ostraka* layout.

Prototypes

Prototyping is seen as an essential design activity because it allows designers to learn by doing as they explore ideas (Camere & Bordegoni, 2015). This is a practice common to many fields, including experience design (Buchenau & Suri, 2000), education (Barab & Plucker, 2002), engineering (Alley et al., 2011), social innovation (Brown & Wyatt, 2015), and instructional design (Merrill & Wilson, 2007).

Engineers at a precision pump manufacturing organization were tasked with creating a new line of pumps for a food processing chain. The pumps needed to be more efficient and have fewer parts than the originals. The core design team was co-located and created prototypes to test their new designs. The use of prototypes contributed to the direct aural and visual communication team members had with each other. The prototypes were critiqued and approved, and in this way they structured the design process for the engineers (Perry & Sanderson, 1998).

As this engineering example illustrates, prototypes are a valuable communication tool. They can provide a shared, tangible view of an idea and facilitate answering questions concretely (Yang, 2005). They can also be used to persuade others to adopt a new mindset because they tangibly demonstrate the merit of an idea. Prototypes can be a source of positive peer pressure to move forward with the development of ideas (Norris & Tisdale, 2013).

Prototyping also reveals information about the designs through the process of fabrication. Creating prototypes reduces design risk because designers can learn about the product-to-be without investing the time and cost required for full production (Yang, 2005). This technique helps designers determine how to fulfill the tasks and requirements that must be accomplished for a given project (Smith, 2014). Designers learn from the mistakes they make on prototypes and the feedback they receive about their prototypes, which then leads to improved designs, as was the case with the prototype pictured in Figure 3. This is an iterative process that continues until they reach a product that will accomplish the desired results.



Figure 3. Prototype of an early iteration of a museum exhibit.

Bodystorming

Bodystorming is a way of developing greater user empathy: designers immerse themselves in situations end users might experience and then focus on the decisions, emotional reactions, and interactive experiences users might have. This approach is based on the premise that the best way to understand an interaction is to experience it personally (Smith, 2014). Participating in the interactions users might have can reduce the time designers spend studying documents of user observation. It allows them to tap into aspects that are unobservable because they have experienced these elements firsthand (Oulasvirta, Kurvinen, & Kankainen, 2003). This technique has the potential to help designers communicate better with their peers, clients, and end users because of the performance aspect of this type of visual (Burns, Dishman, Verpiank, & Lassiter, 1994).

Designers at the Helsinki Institute for Information Technology enlisted 10 researchers and industry representatives to use bodystorming to innovate ubiquitous computing technologies. They spent a full day bodystorming the interactions an elderly user group would have at an old age service house, subway station, the subway, the mall, and a grocery store. They identified problems related to activities performed at each of these locations and framed them as design questions. Those involved were split into two groups to perform the bodystorming. One researcher acted as a moderator, while another served as a group leader. These researchers recorded ideas that emerged and facilitated the experience. They found that bodystorming inspired researchers to become familiar with new contexts and improve their design abilities (Oulasvirta et al., 2003).

This example of bodystorming presents how this visual tool can support the product development process through facilitating communication across peers, clients, and users. Like

the other forms of visual representation, it offers a shared perspective to all involved, which provides opportunities for further discussions (Burns et al., 1994). However, it contributes differently than other visuals. It allows designers to experience, discuss, and evaluate their ideas in context, and helps designers to understand how the settings in which a design is used can affect their intended use (Smith, 2014). This approach is believed to be less error-prone than brainstorming because it allows designers to experience realistic constraints that can affect the user experience (Smith, 2014). In bodystorming, designers rapidly prototype ideas, which allows for immediate feedback on how the product works (Oulsavirta et al., 2003). Discussing the feedback brings up new issues for designers to explore (Flink & Odde, 2012).

As these examples indicate, visual representations can be very beneficial to designers in many fields. However, designers are not generally aware of the influence material culture has on their interactions with others and their ability to collaborate. Thus, little attention is often paid to how to incorporate effective visual representations into regular design processes. In the extant literature, the role of visuals in design has been neglected. In this paper, we sought to increase understanding in this area by studying how museum exhibit designers used visuals in their design process, and what the visuals revealed about the team's functioning. Specifically, we sought to answer the following questions:

1. How do design teams use visuals during the design process?
2. What effects do visuals have on how design teams function?
3. What factors influence how design teams use visuals?

Understanding the answers to these questions will empower designers. They can be more deliberate about their use of visuals and receive maximum benefit from these resources, as both design and communication tools. An awareness of generally unobserved effects of visuals can

also enable designers to address these unanticipated outcomes and work with them, or, if necessary, overcome them. Such knowledge will position designers to collaborate more effectively and may save them from unnecessary setbacks.

Method

This study of an exhibit design process was done not as experiment to test the effectiveness of specific approaches, but rather as an examination of the natural process of planning a new exhibition. The study looked specifically at how a museum exhibit design team used visual representations, such as sketches and prototypes, to communicate their ideas to each other. To explore the use of visuals in the design process at the museum, this research used a case study approach (Stake, 1995).

The case that was studied in this research was selected because it met several relevant criteria. First, our research questions required a high level of access to the design team, so that we could document how they evolved in their use of visuals during a design process. At the time of this study, the lead author was the exhibits manager at a student-run museum and led teams that planned new exhibits. This allowed her to engage with the designers as a participant observer with access to the team's meetings and artifacts for observation. Studying the designers on her team offered several benefits. She had worked with all members of the team for at least six months and had established a collegial relationship with the participants of this study. Her relationships with them ranged from acquaintance to close friendship, which allowed them to feel more comfortable and open with her than they would with an outside researcher. Additionally, she attended the majority of the design meetings and had ample opportunity to observe the nuances of how visuals were used. She also had access to all of the visuals created, which allowed her to see trends over time and across usages of each visual type.

Second, we sought a design team for this study that was typical for museum exhibit design. This museum has a rich history as an anthropology and archaeology museum. Exhibits are redesigned every four to six months and done collaboratively. In addition, with the exception of the museum director, none of the participants on the design team had a background in exhibition design. Each came into the team with little to no formal training in this field; thus, they learned by experience how to design. Because this is true of many other exhibit designers, as the lead author learned through interactions with colleagues at museum association conferences, this was an important criterion in the sampling strategy. As is true of many other designers, the participants in this study came from diverse backgrounds.

Because of the potential conflict of interest, during this study, the lead author enlisted another museum employee to lead the design team so that she could focus on her roles as team designer and researcher. In addition, consent was obtained from the members of the team before initiating the study.

Participants

Participants of the study included all seven members of the exhibit design team. To protect the privacy of participants in this study, their names have been changed. The team consisted of the museum director (Daniel), the museum's curator of education (Rachel), and students from the fields of graphic design, socio-cultural anthropology, instructional design, and archaeology. Ages of the team members range from early 20s to late 40s. Rachel and Daniel both have children and spent time with their families after work. Other team members occasionally socialized with each other after work.

Since the members each had a different role on the design team, they had unique perspectives on the use of visuals. Including each of them gave a complete picture of how

visuals are used and perceived by team members with diverse skill sets and backgrounds. The lead author contemplated the experiences each team member had previously and the number and types of visuals they brought to team meetings. She observed the propensity they had to use visuals during official meetings or more casual conversations and how that behavior reflected their attitudes towards design and visuals. For example, she noted that Rachel was the least prone to use visuals. Rather, Rachel was more focused on getting data from potential visitors to have evidence for design decisions. This reflects the general mindset she has in her museum career. In addition to being the museum's curator of education, she also does evaluation and visitor studies for other museums in the area. Jacquelyn noted other similar connections between team members and their positions at the museum and personal interests.

Context of the Study

In January 2018, the exhibit team at a student-run museum began crafting a new exhibition for the museum's 384 sq. ft. gallery. The team developed the *Ostraka* exhibit (see Figure 4), which opened on April 27, 2018. The exhibit was designed as a social media platform made physical to make archaeologists more relatable to the public.

Walking through the exhibit felt like scrolling through social media, each wall with a different social media aspect, such as memes, posts, and quizzes. Each of these elements was conceptualized in a physical sense so the viewer could physically interact with the content without a digital screen.



Figure 4. Pictures of Ostraka exhibit.

Several iterations of brainstorming ensued to select the main idea for the exhibit. The team initially planned to create an exhibit on archaeology memes. They split into groups and prototyped possible designs for the exhibit. It became evident that a ‘meme’ theme complicated efforts to incorporate archaeological and anthropological artifacts from the museum’s collections. Enthusiasm waned. Eventually the focus shifted to social media in general and ideas began to flow.

As the months wore on, the team experienced several pits and peaks during the design process. Pits included seemingly repetitive meetings, slow progress, and discomfort with critique. Peaks included bonding with team members, prototyping ideas, building the exhibit, and implementing design plans. Although there were several stressors near the end of the

semester, team members and other museum employees worked diligently to ensure the exhibit opened on time.

Data Collection

A variety of data gathering methods were employed in this study, including semi-structured interviews, observation, and artifact analysis. The lead author wanted to understand the role visuals played in this process in these various methods. Interviews revealed participant perceptions of their interactions with visuals. Through observations, she witnessed how visuals were used during the process and heard the conversations that took place surrounding them. Attending design team meetings also permitted her to take note of how visual and verbal ideas evolve and contribute to the final product. Artifact analysis enabled her to track the evolution and development of ideas, and understand how each visual type is used through the design process.

Semi-structured interviews. The lead author conducted two semi-structured interviews with each designer to obtain spaced insights. The first interview occurred about two months after the inception of the design project. The purpose of this interview was to understand how the design team used visual representations early in their design process. The first and second interviews were spaced one month apart, allowing time for transcription of the interviews and analysis of any visual artifacts the designers created, including sketches and prototypes developed during the process. This analysis influenced some of the questions that were asked in the second interview. The second interview focused on each participant's experience with using visual representations and how they were used to facilitate the development of ideas. It also provided an opportunity to explore themes and issues that emerged through analysis of the first interview and the remainder of the design process.

Observation. The lead author attended the majority of the official design team meetings held during the course of exhibition development. During these meetings, she witnessed and documented the use of visuals. These observations provided valuable insight that would have been missed in interviews since participants likely would not have remembered all of their uses of visuals, since the visuals were simply part of their problem-solving process. Attending meetings over the course of the design project allowed for persistent observation. The lead author also participated as a team member; she had daily or near-daily contact with members of the design team (Adler & Adler, 1987).

During observations, she audio recorded the meetings and video recorded any use of visual representations. She noted whether the visual was brought to the meeting by an individual participant or created during the meeting. After the observations of team meetings, each audio recording was transcribed. She also took note of other informal conversations concerning the exhibit about which she was aware.

Document analysis. Lastly, the lead author collected artifacts or copies of artifacts that participants were willing to share, such as sketches, storyboards, and prototypes. This included all visuals that were brought to team meetings and the majority of visuals that were created in informal settings.

After obtaining the artifacts, she then identified the material, and lastly analyzed and evaluated the visuals (Goetz & LeCompte, 1984), first by recording the number of visuals created by each person, the types of visuals they created, how many of each type, and the audience for whom the visuals were created. She noted how many visuals were made by groups and the types of visuals the groups made. She also recorded how many visuals were created on each day of the design process. She analyzed the visual artifacts simultaneously with the

interviews. Details from each of these analyses were triangulated with other information gleaned from the interviews and other interactions with the study participants. Comparing these pieces of information led to deeper understanding of how the visuals affect the material culture of the design team.

Studying these artifacts helped us understand the culture of the team because the “meaning of artifacts is often intensely personal and subjective” (Savenye & Robinson, 1996, p. 1184). Studying artifacts was additionally helpful in building a theory of the material culture of the design team (Hodder, 1998). This method of analysis allowed us to see how visual representations were included in the design team as a part of their culture.

Data Analysis

The interviews and design team meetings were transcribed and preliminary themes were flagged to inform the second interview with each participant. Accordingly, Jacquelyn analyzed and collected data simultaneously to get as accurate a description of the situation as possible.

The thematic analysis process included the following stages: she began with “(1) Gaining a sense of the whole by reading the transcripts and identifying preliminary themes; (2) Refining these preliminary themes into more formal themes—merging, splitting, deleting, adding, editing, etc.; (3) Comparing and contrasting themes to look for connections among them, while continuing to refine; (4) Organizing themes according to metathemes and placing them into an overall thematic structure, while continuing to refine themes and metathemes; (5) Selecting illustrative quotes from the transcripts to exemplify themes developed in steps 1–4; (6) Considering each theme and meta-theme in light of the whole, and continuing to refine; (7) Considering the whole in light of each theme and meta-theme, and continuing to refine; (8) Examining the coherence of the overall thematic interpretation and refining the overall structure”

(Yanchar & Hawkley, 2014, p. 276). This in-depth, iterative process of analysis contributed to the trustworthiness of the findings.

Trustworthiness Standards

Trustworthiness standards presented by Lincoln and Guba (1985) were followed to ensure the validity of the results. Efforts to meet these standards included member checking, prolonged engagement, persistent observation, negative case analysis, member checks, the inclusion of emic perspectives, and progressive subjectivity checks. The confirmability of the findings was ensured by comparing the findings to extant literature on the subject.

Dependability was accomplished by frequent checks with the director of the museum and maintaining a field notes. Transferability was achieved by including thick, rich description of the participants' experiences.

Findings

Extant literature is thorough in explaining how visuals support product development. What is currently lacking in the literature is a description of how visuals influence the design settings in which they are used. Consequently, the remainder of the article will illuminate the findings from this study on the surprising depth of connection between designers and their visuals and how it can affect collaboration, including in negative ways when a design team suffers from struggling relationships.

Because visuals are often created by an individual designer and then shared with others as a communication tool, this section will follow a similar order in its presentation of themes. This section will first present findings related to individual designers and their perceptions of themselves in relation to other people. Next, the relationship between designers and the visuals

they create will be explored. Lastly, the influence of visuals on team interactions will be discussed. The themes presented in this article are as follows:

Theme 1: Perceptions of power and authority influence willingness to share visuals.

Theme 2: Artistic self-efficacy mediates the creation of visuals.

Theme 3: The relationship between designers and their visuals influences how they function on the design team.

Theme 4: Fear of rejection hinders designers from openly sharing visuals.

Theme 5: Visuals can act as escape mechanisms that designers use for self-preservation.

Theme 6: Efforts to protect the feelings of others can make it difficult to critique visuals.

Theme 7: Visuals rectify fluctuating levels of engagement and enthusiasm that occur over time.

Theme 1: Perceptions of Power and Authority Influenced Willingness to Share Visuals

Assigned roles, status markers, and hierarchical structures can create the mindset that specific people are more responsible or qualified to make decisions. This sentiment can be toxic for team dynamics. It can fuel efforts at exerting control and cause others to disengage.

During the semester in which the design team planned and built Ostraka, Nick was in an interaction design class, which required the students to collaborate in teams to develop an app. Nick was in a group with two other graphic design students. He perceived an air of superiority exuded by these classmates. He felt unneeded and invalidated. They did not acknowledge his designs, even when his designs more effectively met some of the project requirements. He explained,

I don't want to compete with them. I'm not as good as them. [That] is my problem:

when I'm not going to make it, I just give up. For them, they'll just see that I'm not as

engaged. They'll just increase their stereotype of me, but whatever. They can think what they want. So, there's stress in there.

The perception of power and authority that Nick perceived from these classmates negatively impacted his experience on the project and led him to disengage and give up. However, at the museum, he was the only graphic designer and was responsible for the visual elements of the exhibit's design. He recognized that he had the authority to make design decisions. During several design meetings, he asserted his authority and pressed certain issues and points of view farther than others on the team were prepared to discuss, as demonstrated in Figure 5. On one occasion when the team was anxious to create prototypes and do user testing, Nick lamented,

I feel like we're doing something that's far past what we're actually trying to accomplish. We are trying to make prototypes before we even know what we're doing. There's no research into the interfaces of these. You've kind of glossed over the internal parts of what actually makes user experience design. I feel like we're not going to accomplish really what we're wanting to by this.

The positive perception of his authority he had at the museum, along with the responsibility to design all the visual elements of the exhibit, made him much more engaged in the design process at the museum than he was with his classmates. He assumed responsibility for making decisions and was willing to debate and justify his reasoning with the design team members, a position he was unable to take for his class assignment. The dynamic at work was such that he had to be engaged and therefore could develop expertise more effectively than he could when he disengaged with his classmates.

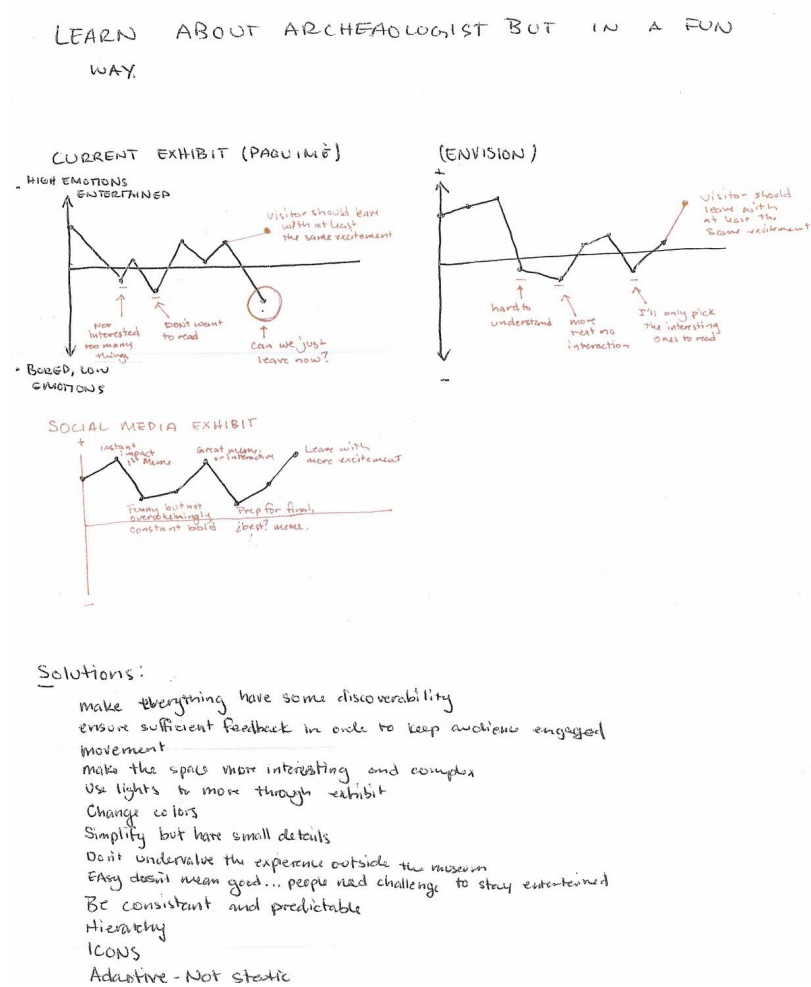


Figure 5. Nick's suggestion of desired emotional outcomes from exhibits.

This theme was noted not only in undergraduate student designers, but also in Daniel, the museum director. During an interview, Daniel described his willingness to visually share ideas in design team meetings compared to other settings. He explained,

There's a closer association with me and visuals, it's more who I am inside. If people aren't willing to accept me, then they don't get anything from me. I'm not going to say anything and I'm not going to do visuals. This is probably bad of me, but they haven't proven themselves worthy, so they don't get it and they'll continue to struggle until they can recognize they're missing something.

During team meetings at work, Daniel felt comfortable sharing ideas because he had good relationships with his employees and felt that they valued his input. He also used his position of authority on occasion to push people to keep exploring when he felt there was value in that exercise. Many exhibits have benefitted from this encouragement and his innovative ideas. However, in other instances in his professional life, such as administrative meetings with other faculty members, he does not always feel valued, so he sits quietly and does not share his thoughts.

As Nick and Daniel's experiences demonstrate, perceptions of power and authority influence how willing designers are to share their visuals and ideas with others. Negative perceptions of power in which designers feel powerless and unvalued may prompt them to disengage and refuse to share. Alternatively, positive perceptions of authority can lead them to be actively involved with the group. Honest feedback can be given and the resultant product will benefit.

Theme 2: Artistic Self-Efficacy Mediated the Creation of Visuals

The self-efficacy designers feel about their artistic abilities, in both design and the creation of visuals, affects how they interact on a team. It has implications for their willingness to create and share visuals, as well as to receive critique on their work. Designers have a keen sense of how their artistic abilities compare with those of their colleagues and this awareness impacts how they interact.

Members of the team had widely varying levels of self-efficacy. Nick had high levels of self-efficacy for making visuals because it was one of his natural talents, he had extensive experience making them, and he was expected to produce graphics and visual material for the museum. He related, "I'm the guy who visually makes everything work. I bring the unity and

cohesion. I make sure that the design elements are met in order to make an exhibit that looks good, but still fulfills its purpose.” He believed in his ability to create visuals and recognized it as a natural way of thinking for him: “I’m going to create visuals no matter what. If I have a pen and paper, I will create visuals. That’s how I understand things better.”

Not all members of the design team had such high levels of artistic self-efficacy. It showed through their orientation towards visually communicating. For instance, Rachel had low self-efficacy for making visuals:

Growing up, I was the non-artistic one in my family. I’m the third child and I was the one who did well in school—in academic subjects. I’ve always felt like I was not disadvantaged, but just like, “Oh yeah, that’s what I’m not good at.”

This attitude was reflected in the relative number of visuals she created. Other members produced between eight and 66, but she only created two (see Figure 6). Rachel preferred to communicate using other modalities because they came more naturally to her. She explained that she felt like her sketches are always really sloppy, but with prototypes there is less pressure for the product to look polished: “This is just something crazy with foil and wire. It’s not expected to be this nicely sketched and proportional sort of thing. It’s just to get an idea out there.” She enjoys making prototypes, yet feels that she is stretched in doing so: “I think that’s a little bit of a leap for my personality to be able to do that. It is kind of a push for me to be vulnerable that way. But at the same time, it’s fun.” Rachel expressed that for her to get to the point that she would actually make visuals, she would have to set other things aside and make it her top priority for an hour.

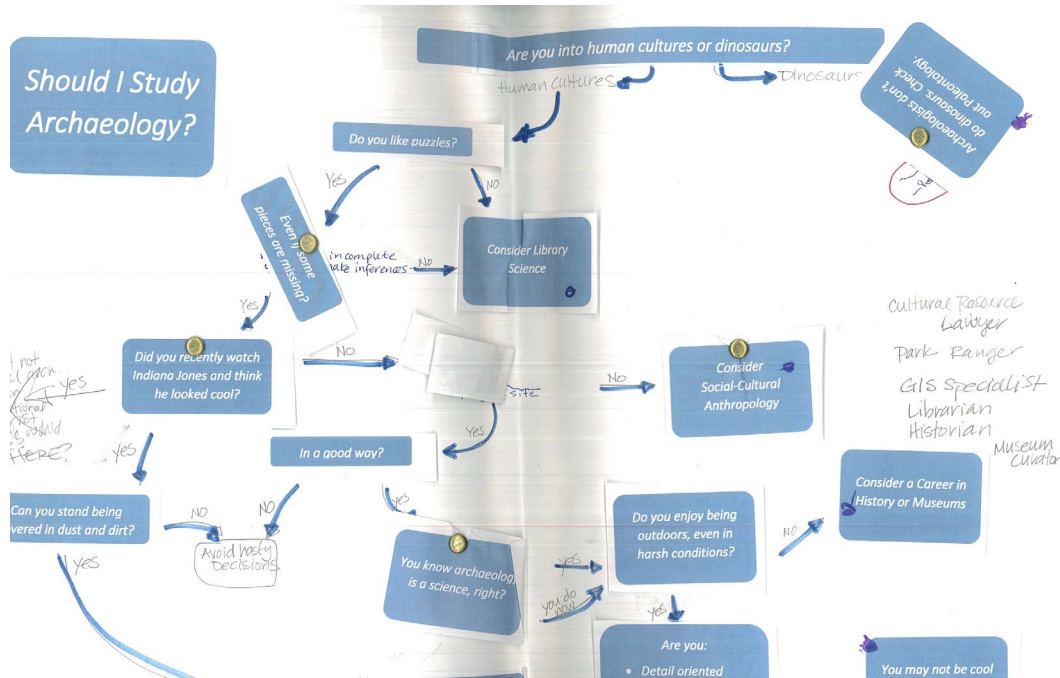


Figure 6. Rachel's prototype for the decision tree.

As Rachel and Nick's experiences illustrate, artistic self-efficacy can have a significant impact on how likely designers are to create and communicate with visuals. For some, doing so is completely natural, but for others, visual communication is a stretch. Low levels of self-efficacy are not entirely prohibitive, but it may take extra effort to compensate for them.

Theme 3: The Relationship Between Designers and Their Visuals Influenced How They Functioned on the Design Team

As Henderson (1998) indicated, visuals are primary players in how design cultures are constructed. She suggested that visuals can influence participation on a team and that managerial politics can infiltrate the use of visuals, thus affecting the team's level of creativity and innovation. What she did not address is the relationship between the individual designer and the visuals he or she creates. The current study found that designers can feel a strong connection with their visuals because they are a personal reflection of their identity and abilities.

For the second design meeting, team members were asked to bring visuals representing their three favorite ideas for the exhibit (see Figure 7). Rose brought three sketches with written descriptions of each idea. Most other team members brought images found from Google searches. Nick printed images, drew sketches of each layout, and got paint chips to demonstrate the colors he envisioned for each exhibit. He attached all of these components to pieces of foam core and used these very elaborate visuals to present his ideas to the group. His visuals stood out amongst the others. When asked how this experience felt, Rose explained,

I wanted to hide mine. Especially after Daniel made a comment about [how he] wouldn't mind drawing on mine, but he would mind drawing on Nick's. It was embarrassing. It felt like I was slacking off or not putting forth as much effort, which obviously I didn't, but it wasn't on purpose.

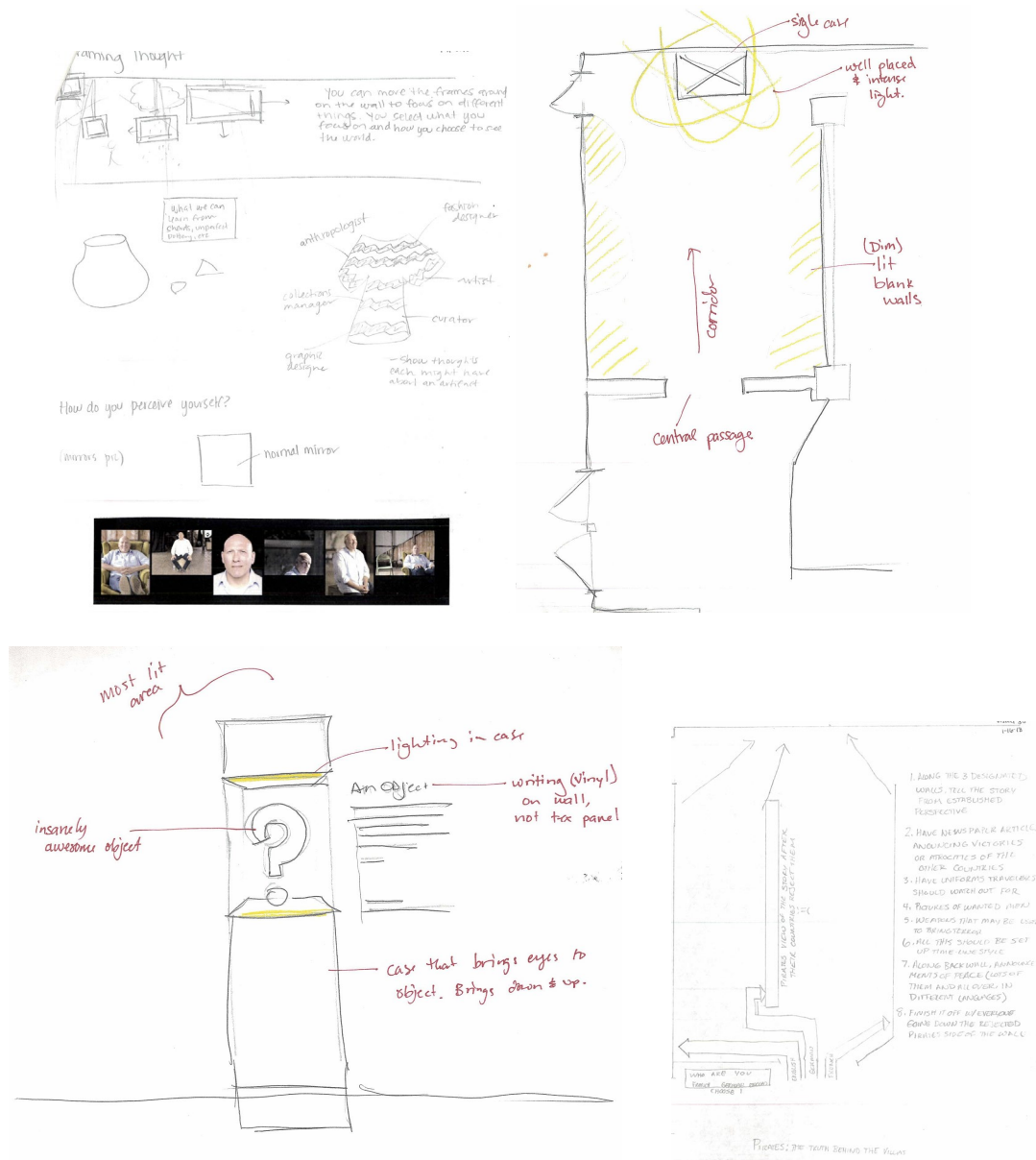


Figure 7. Visuals by Jamie, Nick, and Rose.

Rose recalled that she did not interpret the assignment in the same way Nick did, and that she had a different understanding of what was expected for the assignment. She went on to describe how this experience affected her connection with the team:

No empathy. I had none. I was too focused on myself. That’s when I think I disconnected. I didn’t want to make any decisions. Being disconnected led up to that

eventual meeting where I meant to say, “I’m fine with whatever people choose,” but it came out [as] “I don’t care.”

After this experience, Rose felt disconnected from the team for several weeks. She was unmotivated to do many of the assignments when she felt that her work would be compared to the ideas of others. It was only after assignments were differentiated and she was able to work on tasks that were interesting and aligned with her skills that she reengaged with the design team. She wanted to feel that her work was uniquely valued and contributed meaningfully to the team. Her attitude reflects the close connection she had to her visuals. This situation illustrates how the relationship between designers and visuals can affect engagement on a design team.

On the other hand, Nick had a background in graphic design and felt very confident in his ability to develop and analyze visuals. He put a great deal of effort into all of the visuals he created during the entire design process and felt assured of their quality. He also developed at least 10 possible versions for nearly every visual he created, so he did not feel emotionally attached to any of them (see Figure 8). His professional training, high artistic self-efficacy, and detached relationship to his visuals enabled him to take a more critical approach to the visuals presented. This contributed to the critiquing role he assumed during meetings. Nick explained the difficulty in interacting with people who are closely tied to their visuals:

Most people don’t have that design background or know as much about that stuff as I do. It’s really hard for me to interact with people who create their own visuals. If I create visuals and they critique it, that’s fine. But that’s really hard for other people.

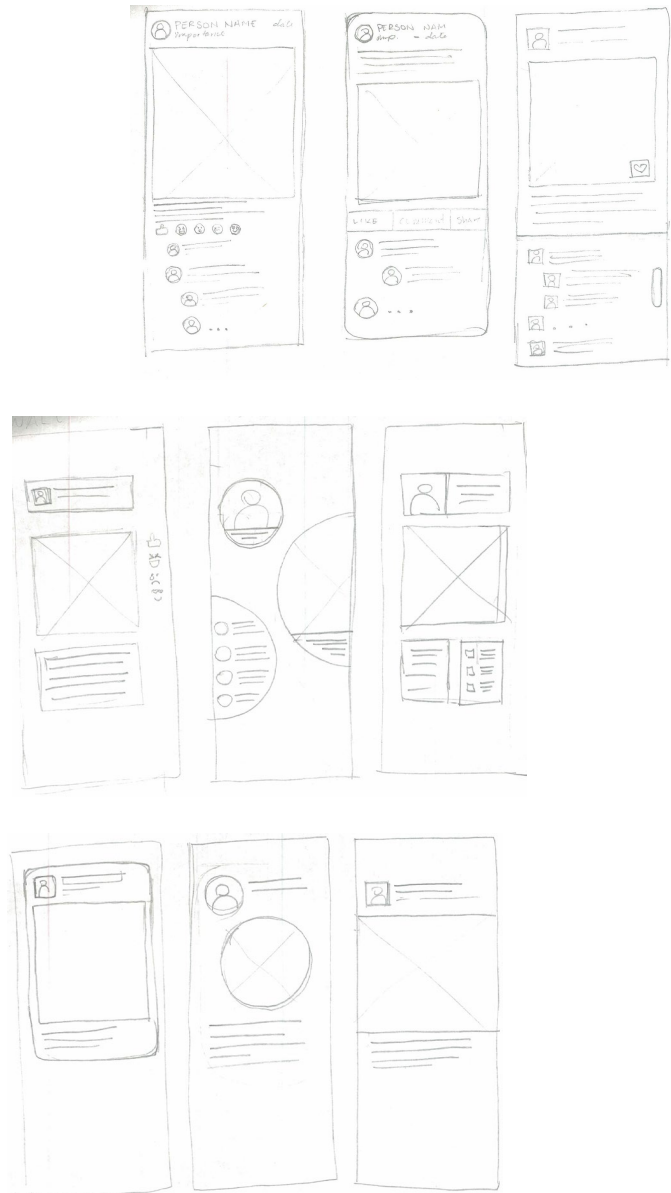


Figure 8. Nick's variations for text panel styles.

Rose and Nick demonstrated extreme cases of the relationship designers may have with their visuals. Designers may feel ashamed of what they create, leading to hesitancy to share and even disconnection from the team. In contrast, they may feel totally confident in their work and use that confidence to exert influence on the team.

Theme 4: Fear of Rejection Hindered Designers from Openly Sharing Visuals

Inherent in the process of sharing is the possibility of rejection, an experience which most would choose to avoid. Rejection or invalidation of an idea can feel like a personal rejection, which can decrease a designer's willingness to engage. This susceptibility may get in the way of designers communicating visually. This phenomenon occurred in Daniel. He explained,

I'm not really that great of an artist. It's easier for me to be vulnerable with sketches because with really quick sketches, nobody can criticize me for my inability to draw. So, it's like a vulnerability and a safety at the same time.

Nick also demonstrated a similar fear. He directly explained his thought process regarding how the fear of rejection influences the willingness of designers to share with others:

Every time you show something, [they're] able to see more of the flaws. You're making yourself even more vulnerable to critique [and] comments of people not liking or understanding things. There's a lot more that comes of it when you have more visuals because [they provide] more information. Opinions are more informed and [there are] greater consequences.

Because there is the possibility of a harsh repudiation of an idea, designers may hold back from sharing. Such a choice is an act of self-preservation, which can be a motivating need for designers if they do not feel comfortable sharing. However, fear and hesitation will prevent new revolutionary or creative ideas from developing.

Theme 5: Visuals Acted as Escape Mechanisms that Designers Used for Self-Preservation

In this study, designers were keenly aware of how their artistic and creative abilities compared with those of their colleagues. If designers perceive their abilities as lacking, they

may seek for alternative ways to present their ideas that allow them to preserve their pride (see Figure 9). For instance, Lydia explained,

That is actually one of the reasons that I stuck pretty strictly to Google image search stuff that could be printed; I'd rather rot than draw something and show it to somebody who can [draw]. That's a personal thing. It's been that way my whole life and it's still true. I just—I would never.

For Meeting on 1/16/2018

further prototype your 3 ideas

Fashion Show

Purpose: objects look so flat and one dimensional on display. This exhibit, displayed in two parts, would show what the clothing should look like on a person. The clothes would be on display in the same flat manner, then there would be a large screen with a video. The video will be footage of the fashion show we put on.

The fashion show would be held in a large space like the WSC, and people would go down a catwalk actually wearing the objects (with protective wear underneath so the objects aren't harmed). The models would be dressed and HMU would be done to focus on the clothes. The fashion show would be filmed and then played in the gallery.

Potential list of objects: kimono, tapa cloth shirt, Indonesian wedding skirt, chain mail helmet, some of the historical clothing collection



Figure 9. Lydia's computer-generated exhibit idea proposal.

The lead author also saw evidence of using visuals as a form of self-preservation in her own experiences on the team. She preferred to draw out her ideas with great detail so her finished products looked more polished. She believed that having better-looking drawings

would leave less opportunity for others to judge her on her artistic abilities. As she talked with Daniel about the early prototypes she made for Ostraka, she explained that she would rather have somebody see a prototype she'd built than a sketch she'd done. For her, a sketch seems like more of a personal reflection than a prototype she'd built. In response, Daniel suggested:

It's not just that some visuals make you feel more vulnerable. It's that they'll also provide an escape. It's like, 'I couldn't do this well because I just had cardboard and tape, but you get the idea.' That's kind of anti-vulnerability. You're building an escape mechanism.

As Lydia's and the lead author's experiences demonstrate, designers may select visuals not for their ability to effectively convey an idea, but for the safety and self-preservation they may afford the designer. While attempts at self-preservation may be extremely motivating and fill a temporary need for the designer, they can be detrimental to the team. If designers use visuals for anti-vulnerability purposes, rather than the development of the product, both their personal development and the development of the product could be hindered.

Theme 6: Efforts to Protect the Feelings of Others Made it Difficult to Critique Visuals

Giving and receiving critique can be an uncomfortable process. Being critiqued can be distressing because designers feel a keen connection with the ideas they present to the group and dismissal of an idea can feel like a personal rejection. The environment in which the team works must offer enough psychological safety that designers still feel valued even when their ideas are not selected.

Everyone on the team was acutely aware of how critique might be perceived by other team members and did not want to hurt anyone else's feelings. Of giving critiques to members of the design team, Nick said,

A lot of times I'm afraid to tell them. People get offended that you're discrediting their work [and] saying it's not worth it. That's not what I'm doing. I'm just critiquing and saying, "Here are your flaws. Here's where it needs to improve."

As Nick's explanation demonstrates, designers have a profound awareness of how others might receive feedback. This interpersonal dynamic and desire for harmony can make it difficult to critique ideas effectively, which can hinder the design process.

This played out in one of Jacquelyn's experiences building a prototype (see Figure 10). In late February, she recorded in her field notes:

On Friday I started prototyping for the exhibit. No one seemed to want to talk to me about prototypes, so I just started building the advent calendar out of foam core. Part way through, Daniel came and showed me an easier way to cut things out. When I finished, he said it would have been easier for me to build up instead of cut out. In hindsight, he was right.

Later I showed Nick what I'd done. He critiqued it and expressed concerns. I was really frustrated. I knew he was right, but I was annoyed that he waited until I was done building it to tell me all the problems with it. He was too busy to be bothered with it earlier. And even when he was hanging around talking to me, he didn't say anything. I didn't like the attitude Nick and Daniel had of not thinking about it until I was done. At that point, they told me the problems with it and how I could have done it better. It didn't feel helpful. Nick could tell I wasn't happy and he apologized and essentially said he wasn't trying to disparage my work. I knew that, but I was annoyed and tired and didn't have feeling in my thumb. It was upsetting to know that I had gone to all that work possibly for nothing!

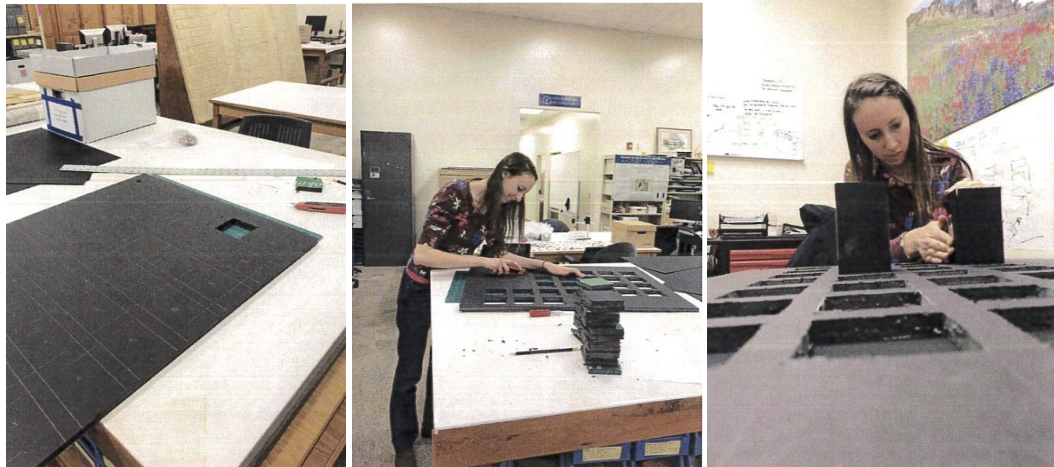


Figure 10. Prototyping the analog Pinterest board.

The lead author's frustration with this experience shows how hard it can be to determine when and how to appropriately and effectively offer critique. Because she did not receive useful feedback from Nick or Daniel till the end of her creation process, she felt invalidated and unsupported to the point that she wanted to disengage. She spent hours on the prototype and felt deeply connected to it because of all of the effort she invested. She would have been more receptive to evaluation earlier in the process when she was not already committed to a specific path. The close connection she felt to the product made it irksome to hear anything negative about it. When Nick recognized the circumstances, he apologized and helped her discover an effective alternative. His behavior demonstrated the high level of conscious effort required to navigate the dynamic of giving feedback while still maintaining positive working relationships.

Theme 7: Visuals Rectified Fluctuating Levels of Engagement and Enthusiasm That Occurred Over Time

Visuals can be used to energize team meetings and the entire culture of the design team, a phenomenon that occurred many times during this study. Near the end of the design process, many of the meetings were repetitive and little progress was made, leading to frustration and

disengagement. Nick thought that certain decisions had been neglected, so he called an impromptu meeting, a portion of which included bodystorming in the gallery. As a result of this meeting, several decisions were made that allowed the team to progress again. The week after the meeting, the team continued bodystorming. To determine the width of columns that would be built, they held up the plywood that would be used. As some team members held these boards in place, others walked around to evaluate the feeling of the space. With this decision made, further progress could be made on the construction and installation of the exhibition.

As this example illustrates, bodystorming in the gallery enabled the designers to engage more actively and efficiently in the decision-making process. This exercise enlivened the meetings. It required the designers to be physically active and intellectually involved, a refreshing change of pace from passively listening at a table during design meetings. The flexibility to use visuals as the situation warranted helped designers make decisions. Such flexibility requires designers to develop an evaluative mindset through which they can assess and meet the needs of the situation.

The previous example illustrates how visuals can improve engagement on a group level; they also have a similar effect on individuals. The lead author's own engagement in the design process ebbed and flowed. One morning during the brainstorming phase, she built two prototypes (see Figure 11). She reflected in her field notes:

As I worked, I wondered why I was making these visuals. I felt bored and stuck with coming up with ideas off the top of my head. I wanted to do something with my hands, something physical. It helped energize me and kept me more engaged in the process than writing on a piece of paper. Today not much was coming. I didn't know what else to do, so I built.

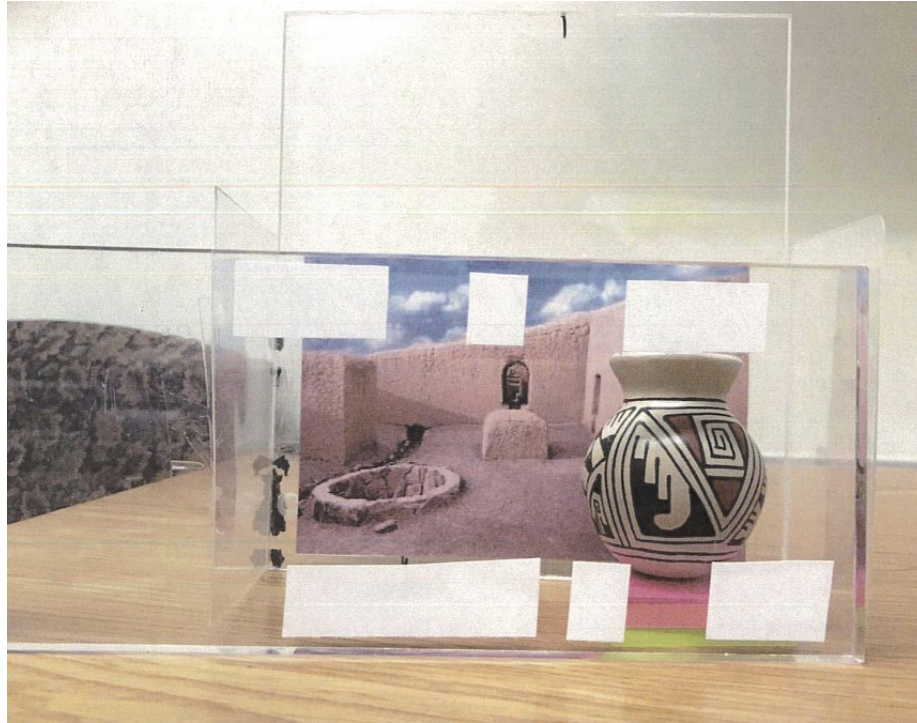


Figure 11. Prototype of possible case design.

The lead author had the wherewithal and maturity as a designer to recognize that the assignment she had been given was not working for her. She modified it and used visuals as a way to stay engaged and contribute uniquely to the design process.

Another way visuals can enliven the design process is by providing opportunities for designers to create together. This activity can bond team members together and foster better communication, providing a foundation that supports the balance of giving critiques and validation. Rose initiated building a roller box prototype to test how the action of scrolling could be incorporated into the exhibit. She worked with Arianna to color a long strip of butcher paper that would be included in the prototype. Laughing and coloring together on the floor was a bonding experience for them. It assisted in strengthening their relationship, making it possible for work issues to be resolved quickly and easily. Having strong relationships such as theirs helps designers feel supported in their personal and professional development.

Lastly, visuals can improve engagement by structuring discussions and facilitating decision making. The first six weeks of the design process were spent brainstorming ideas and trying to pick an overall purpose and objective for the exhibit. Most of the team felt antsy about the lack of progress being made. One Friday in the middle of March, Nick and Jacquelyn spent the entire day developing a layout for the exhibit. After receiving approval for the general floor plan, they spread their work out on the floor and selected ideas for design elements to include in the exhibit. They created a bird's eye view drawing of the gallery (see Figure 12), which they used along with other pictures and prototypes, during their team meeting to present their ideas.



Figure 12. Bird's eye view map of the Ostraka exhibit.

Due to their efforts, important issues were discussed and decisions were made. Rachel told Jacquelyn later,

I really, really appreciated how you and Nick took the initiative and did that layout.

When we were doing that, it felt like we got a little bit of flow going there, and it was the visual that facilitated that because we all had something to focus on rather than all these just abstract ideas floating in our heads.

As these examples demonstrate, visuals can be used for far more than just developing and communicating ideas. They can also enhance the experience for designers and foster re-engagement when designers feel stuck or disconnected. Thus, they are a powerful tool for supporting the development of products, people, and working relationships.

Discussion and Conclusion

This study goes beyond extant literature about individual visual types to explore how material culture mediates the collaboration of design teams. While other studies indicate that visuals represent the distributed cognitions of design teams (Henderson, 1998), this case study delves into other relevant interpersonal factors that influence the relationships between team members and the willingness to share ideas visually. To understand these nuances, the lead author participated in and recorded the design process of a museum design team and interviewed each team member twice during the experience.

Studying this design team revealed that there is more to collaboration in design teams than following all the correct steps of a given process model. Design is more than just using tools or meeting the needs of end users. There may be significant undercurrents at play within and between designers. The designers in this study came from different backgrounds and had different talents and abilities. However, many of them shared a need to feel valued by others when they contribute ideas. This need impacted the visuals they used and their willingness to show visuals they had personally created. There were occasions when designers did not feel

comfortable sharing their visuals, so they chose not to and became less engaged in the experience.

Visuals have significant, potentially unanticipated effects on the collaboration of design teams. The implications of these findings are that design teams should be aware of the relationship designers have with their creations and structure team interactions and cultures to be supportive and validating. As the connection between people and the visuals they create is first understood, then valued and validated, people will become more willing to embrace the vulnerability required to share their ideas. Enhanced collaboration and better products will follow.

The team dynamics must be such that there is psychological safety. This will help designers feel more comfortable with critique and will help reassure them that the critique is not personal. Rather, it will help them recognize the intent for which critique is given. When there are relationships of trust and designers feel valued, it is much easier for critiques to be present in the discussions.

When this dynamic is established on a team, designers may be more able to embrace vulnerability and willingly share their visuals. Through this process, they can increase their creative confidence. In a supportive setting, designers can grow personally as they develop their design skills. As a result, the products they create will also improve.

Further research in this area could explore methods of creating psychological safety among team members. More details about the intersection between material culture and group interactions would be helpful in determining how to maximize a team's potential.

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ARTICLE 3

**How Design Team Leaders Can Create a Transformational Culture
in Museum Exhibit Design**

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Abstract

This article is written for museum exhibit design team leaders. It synthesizes literature about leadership and various design practices and combines it with the professional experience of one of the authors who worked in the museum exhibit design field. It suggests ways that leaders can re-conceptualize the design process to capitalize on seemingly negative experiences. It also provides ideas for how to support individual designers in the professional development they will experience throughout the design process. Disciplines of effective leaders are presented, including teaching about communication, listening and observation, and guiding from the side. Actionable ideas are offered for leaders to implement in their exhibit design teams.

Keywords: transformational leadership, museum exhibit design, transformational design culture.

Introduction

In this article, written for exhibit design team leaders, principles are presented for supporting the professional development of team members, encouraging confidence in expressing creative ideas, and fostering interpersonal relationship. This paper is designed to offer practical solutions to exhibit design team leaders that will help them provide better leadership and support to their teams.

As the exhibits manager at a student-run museum I (Jacquelyn Johnson), faced a dilemma during the most recent exhibit my team constructed. In addition to building innovative and engaging exhibits, I had a few personal goals for the design experience: (1) build the capacity of each designer on the team and ensure that each team member learned something from the design experience, (2) help team members feel confident and comfortable expressing creative ideas, and (3) encourage strong interpersonal connections between team members. As a student myself, I was baffled by opposition to my goals, including issues such as disengagement among team members and conflict stemming from ineffective communication. Puzzled by the question of how to effectively achieve my goals, I looked to the museum's director Daniel (name changed) for guidance about how to approach these issues.

Through discussions with Daniel and my own pondering and studying the situation, I began to recognize potential solutions to the issues plaguing my team. I was inspired by Liz Wiseman's belief that "most people in organizations are underutilized" (Wiseman, 2010, p 16). Wiseman posited that rather than hiring the most intelligent people who can quickly solve problems, organizations could be more successful if they could access the untapped true genius of their employees. I believed that with the right approach, I could leverage the natural creative abilities of my team members and build their capacity by helping them to develop professionally.

This paper presents solutions to each of my questions. It first discusses the relationship between designers and their ideas because this relationship has a significant impact on team interactions. Second, it explores approaches for building the capacity of team members, including introducing new perspectives to the team, listening to and observing team members and adapting to meet their needs, and offering guidance as needed rather than micromanaging. Third, it discusses how to help people tap into their creative potential, including approaches such as providing experiences for individuals to practice, helping team members re-engage when they have withdrawn from the team, and how to foster and model creativity. Lastly, it suggests ways of encouraging connection between designers such as learning how to communicate, conflict resolution, teaching about communication, investing in these relationships, and structuring collaboration deliberately.

Design Context

The background for this article comes from design experience. I, the lead author, was the exhibits manager at an anthropology and archaeology museum and led the exhibit design teams described in this paper. The second author is a professor of instructional design and the third author is a professor of experience management. In my role as the exhibit manager, I conducted meetings, coordinated efforts of the team through the entire design process, and oversaw/participated in the de-installation and installation of exhibits. For this exhibit the team had seven members; to protect the privacy of the designers, all names have been changed in this article, with the exception of my own.

The team consisted of the museum director (Daniel), the museum's curator of education (Rachel), and students from the fields of graphic design, socio-cultural anthropology, instructional design, and archaeology. Together, this team took four months to design and build

an exhibit called *Ostraka*, which opened on April 27, 2018. The exhibit was designed as a social media platform made physical to make archaeologists more relatable to the public.

In this article, I report reflections based on observations, semi-structured interviews, and artifact analysis from this design experience. The full report of this research and analysis are published elsewhere (Johnson, 2019), but I will draw on insights from the study of this team for this article.

Recognizing the Relationship Between Designers and Their Ideas

Through designing exhibits during my tenure at the museum, I became especially excited about the use of visuals such as sketches and prototypes during the design project. I set out to study how these visual tools were used by design teams. Extant literature discusses how visuals are used to accomplish certain tasks in design (Suwa & Tversky, 1997; Dorst & Cross, 2001; Do, Gross, Neiman, & Zimring, 2000). Rather than revealing specific instances in which each tool was useful, what I found was that visuals are about more than creating, testing, and communicating ideas. In several instances on my design team, the designers had strong relationships with their ideas, or in other words, they felt their ideas were a reflection of them personally. Because of this close association, when a visual was on display to others and was subject to critique, the designers themselves also felt vulnerable to critique. In some cases, the critique of a visual or the decision of whether or not to use an idea were taken personally. Additionally, the designers on my team were keenly aware of how uncomfortable it could be to receive critique from others, so they were hyper-aware of the feelings of their teammates and hesitated to give honest feedback on the visuals presented.

Presenting ideas visually was a vulnerable experience for many designers on my team, especially when they had low levels of artistic self-efficacy. I noted that only when

psychological safety existed between team members did they feel supremely confident and comfortable sharing their ideas (Google, n.d.). Open sharing of ideas was facilitated by mutual feelings of respect, validation of visuals and ideas, and friendships outside of the working relationship. Without these factors in place, the team ran into issues of feeling invalidated, unneeded, and ultimately decreased engagement with the team.

I noted that it is essential to be highly aware of the influence visuals have on the team culture. The relationship between designers and their visuals should be more than simply recognized. It should be honored and used as a catalyst for structuring team functioning. This awareness is foundational for understanding the nuances and undercurrents of how team members interact with each other. Neglecting the impact these inanimate objects have on interpersonal relationships would be dismissing a significant factor in the work environment. This oversight could cause leaders to miss out on potential opportunities to validate and support their teams in their professional development and may be detrimental to the team's functioning.

Building the Capacity of Individual Designers

Supporting the professional development of team members is one function that team leaders ideally should fulfill. However, in many cases, leaders may not take advantage of this opportunity. The reasons may vary, but one possible explanation is a lack of understanding of how to do so, as was the case in my experience. This section presents ideas for how to build the capacity of individual designers so they can develop useful skills for their careers.

Introduce New Perspectives of Experience

Exhibit designers are equipped to consider the experiences museum patrons have as they visit an exhibit. However, they may be less self-aware regarding the experiences they have as a design team. There is value in being deliberate about how the design process is experienced by

the team because the way people perceive an experience, along with the associated expectations, have a profound impact on how they react to it. People tend to remember the peaks (best moments) and the end of an experience (Kahneman & Tversky, 1999). There is an entire field, the field of experience design, dedicated to structuring experiences based on this principle. In the realm of experience design, practitioners dedicated a significant portion of their work to elevating the pits of an experience, in other words, the negative defining moments that may include pain or anxiety (Heath & Heath, 2017).

This aspect of experience design also has relevancy for exhibit design team managers. In many cases, experience design takes the form of managing the expectations people have about the experience before it even begins (De Lange, Heilbron, & Kok, 2018). These expectations can stem from internal beliefs, previous experiences, needs, opinions, and values. For instance, Disney knows that guests don't enjoy waiting in long lines, so they transform this potential pit into a peak that enhances the experience. While waiting in line, people can interact with performers and other interesting displays (Heath & Heath, 2017).

Like Disney, design team leaders can also capitalize on principles of experience design as they structure the interactions of their members. Being deliberate about how their team collaborates can enhance the quality of the experience. Team leaders can seek to understand the beliefs, personal experiences, and needs of their team members and then appropriately manage their expectations.

All aspects of Disney's approach may not transfer over smoothly to every design process, though. Striving to elevate pits into peaks is a great way of improving an experience; however, it may be impossible to orchestrate all aspects of an experience in advance. For instance, in a museum design setting, prototypes may fail or team members may not share a united vision of

the direction a design should go. Such experiences could be seen as pits in the design process. Other examples could include instances of conflict or contention between colleagues, poor communication, disengagement, stress from tight deadlines, or frustration with continued failure. On the other hand, peaks could be moments of triumph when prototypes work as anticipated, the team is energized and engaged, and creative ideas are flowing. In this context, pits are not inherently bad and cannot always be avoided. Rather than trying to prevent pits in the experience from happening, an alternative approach is embracing them when they happen. Maintaining a “big picture” perspective can help designers avoid getting caught up in the negative points of the experience.

Encourage Self-Awareness as a Collective Unit

With proper support and training, designers can recognize that pits are temporary and can play a valuable role in the design process. These moments can be leveraged for the purpose of slowing down and connecting with others to strengthen relationships. For instance, in *Creative Confidence*, Tom Kelley and David Kelley (2013) shared insights from psychologist Julian Gorodsky and former Stanford school student Peter Rubin: a list of six principles for caring for and feeding an innovation team, developed to help team members be more supportive and empathic in their collaborations. They suggested that designers should “(1) know each other’s strengths, (2) leverage diversity, (3) get personal, (4) put the “relationship” back in “working relationship,” (5) craft your team experience in advance, and (6) have fun!” (pp.190-191).

In essence, Gorodsky and Rubin said that designers need to understand themselves, and their team members, in order to be most effective as designers (as cited in Kelley & Kelley, 2013). Johnson also found that having a level of self-awareness helps museum designers collaborate more effectively. When these designers have an awareness of how they respond to

pits in an experience, they can communicate the support they need from others. Knowing this information about coworkers equips co-designers to step in to support struggling colleagues. Being prepared with the skills necessary to be introspective, empathize with colleagues, and communicate effectively allows museum designers to harness self-awareness and an awareness of others and seamlessly shift gears as they enter into the pits of an experience. Such a shift will allow them to continue to be productive throughout an entire experience.

If exhibit designers can assess the needs that arise in each situation and accordingly adapt their expectations for the outcomes of a certain phase of the design process, or the interactions that take place during various phases, they will be able to accept both the pits and the peaks and harness all aspects of an experience to build team relationships, enhance collaboration, and ultimately develop better exhibits. Exhibit managers can support their design teams in achieving these outcomes by taking time to listen to each team member individually, observing patterns of interaction, and making necessary adjustments based on their observations.

Listen and Observe

Another way leaders can build the capacity of their employees is by humbly listening to others rather than assuming they have all the answers. Liz Wiseman (2010) suggests that multipliers focus on how to know what others know and are interested in every insight that is relevant. She described an executive who took the time to listen to a junior team member, even after 12 hours of debate. This individual's comment turned out to be the crucial insight the team had been missing (Wiseman, 2010).

The practice demonstrated by this leader is critical to implement in design settings. Cross-disciplinary design teams, such as the one that existed at the museum, likely have access to a variety of perspectives. While it may be difficult to maintain an open mind, a confluence of

different insights can allow products to be more innovative than they would be if only one perspective was valued.

Listening can take the form of valuing the contributions of others; it can also be implemented by honoring the natural genius of each team member. For instance, Daniel recognized that employees feel more engaged in the creative process when they are given assignments that are well suited to their natural interests and talents. In his years as museum director, Daniel made concerted efforts to place his employees in positions for which they are well suited. He explained, “I try to reflect back on how this [is] going to help someone in their life. If it causes them more stress and negative discomfort because it’s not helping them meet their objectives, then it’s not a good project for them.” This approach allowed him to tap into the creative genius of each of his employees, making their work experience more meaningful. He explained that when he came back from graduate school to work at the museum,

It was the first time in my life where I felt like I had the authority to listen. I didn’t talk at all. I just wanted to find out what was going on. This one girl was like “I’m not very happy. I almost quit.” I opened up the discussion and got her talking. I thought, “Well, you’re in the wrong spot.” I was like, “Well, let’s change this.” I didn’t know if it was the right answer, but we tried it and she loved it. It was just listening and helping her find who she was. Listening is the answer to so many other things.

Years of experience helped Daniel understand that people want to explore their interests; they want to push themselves but most have never been given the opportunity to express their interests and pursue them. It was important to Daniel that he listen to his employees and adapt the work situation for them to help them be successful, rather than just making sure positions were filled and tasks were being accomplished. Wiseman explained that when multipliers

provide a challenge, “people see the stretch, are intrigued, and become intellectually engaged . . . This process of ownership and stretch continues to build energy by creating the intellectual muscle for the challenge” (Wiseman, 2010, p. 118). Daniel created a culture in the museum in which he was able to discover his employees’ interests and give assignments accordingly. He strived to support people in their exploration and development by listening and allowing people to push themselves.

This attitude was also reflected in Daniel’s leadership style. He let his employees experiment with new ideas and approaches as they completed their work. Daniel paid for one of his employees to attend a conference about experience design two years in a row. During this conference, she received training that helped her consider the experiences museum patrons have in the museum’s exhibits. She also used the principles she learned to brainstorm ways of innovating the functioning of the design team. She ultimately was able to present these principles in a museum conference the following year. Daniel’s willingness to invest in her exploring new interests benefitted the museum exhibits she created, the culture at the museum, attendees of the museum conference, and her professional development. She felt fully supported in exploring these interests and applying them to her work because of Daniel’s leadership style.

Guide From the Side

Wiseman suggested that rather than micromanaging employees, multipliers give people control of results and invest in their success. She provided the example of Narayana Murthy, the man who developed Infosys Technologies into a \$10 billion company. He was well respected in the organization and could have easily stayed there to enjoy fame and power. Instead, on his 60th birthday, he stepped aside as CEO and gave the position to another one of the cofounders, Nandan Nilekani, and stayed on as a nonexecutive chairman and chief mentor of the company.

He'd spent years investing in the success of others and said his primary role was to ensure successive generations of leaders (Wiseman, 2010).

Likewise, Johnson (2019) found that as the museum's director, Daniel invested in the growth of his employees. He observed situations and acted as a resource when employees have questions, rather than micromanaging them. He offered guidance when necessary, but mostly allowed employees to learn by experience. Under his leadership, discussions about how to approach situations happened naturally. Employees could bring questions and concerns to him rather than having him be overly directive or prescriptive in his efforts to mentor. For instance, Lydia, the exhibit team lead during this study, had never filled this position before. She counseled with Daniel about management questions. He didn't explicitly tell her what to do but was available to listen and discuss issues when she had questions. He was able to function in this way because he was so consistently open and curious and did a significant amount of listening, he had developed trust with his employees. He asked thought-provoking questions that encouraged people to consider new perspectives, which generally helped them solve their problems.

These two examples show how leaders can learn principles of how to guide from the side. Their main focus should be on setting their employees up for success. To do so, they should invest in the growth of the team members. They can offer support by observing situations and answering questions rather than micromanaging. Wiseman also suggested a leadership approach called the "extreme question challenge" in which a leader only asking questions rather than making statements (Wiseman, 2014, p. 93).

Developing the Creative Confidence of Designers

The issue of developing creative confidence is a popular issue among designers, as evidenced by the book *Creative Confidence* by Tom Kelley and David Kelley. The book is based on the belief that everyone can be creative. Kelley and Kelley explained that as people practice the methods that build creative confidence, they develop “breakthrough ideas...and work creatively with a team to develop something truly innovative. They surprised themselves with the realization that they are a lot more creative than they thought” (2013, p. 5). Their book is based on the premise that individuals can tap into their creative genius and grow as they develop higher levels of creative confidence.

In this section, I will present principles design team leaders can use to help designers tap into their creativity. For each principle, an illustrative case will be included, along with a description of the situation that led to a change in the designers. For the museum examples, I will also provide an account of how the designer thought and acted before and after the transformation they experienced, as well as the elements of the situation that led to the development of new mindsets.

Provide Individualized Attention to Encourage Re-Engagement

During my recent exhibit design process, at a brainstorming meeting early in the design process, Rose had a negative experience when Daniel inadvertently compared her sketches to those of the team’s graphic designer. When word of the offhand comment reached Rose, she felt ashamed. She related, “I wanted to hide mine. It was embarrassing. People tended to have nicer stuff.” Her shame led her to disengage from work, jeopardizing the project.

Once Daniel realized there was a problem and intervened, Rose seemed to become a different employee. She volunteered to develop a BuzzFeed-style quiz to engage patrons, which

gave her the opportunity to learn how to format the questions and add pictures to the digital interface. She felt a sense of pride knowing she was contributing something unique to the design and explained, “I felt like it mattered more, so it was actually important to me to get done.” She went from feeling vulnerable and ashamed and believing that she wasn’t a valuable contributor, to feeling a great deal of pride and satisfaction in her contributions along with a willingness to develop further. What prompted Rose’s transformation?

Several factors facilitated the new mode of engagement Rose developed. First, direct mentoring from Daniel helped her work through the attitudes that caused her to withdraw. These efforts enabled Rose to recognize the importance of fully engaging in collaboration. A second, related effort that supported Rose in her re-engagement was the validation and praise other colleagues provided encouraged her to keep demonstrating those behaviors.

Another factor that contributed to her re-engagement with the team was the opportunity to learn new things. When speaking of creating the quiz, Rose expressed “I just had fun actually learning to do something new. I need variety in life and that provided it.” Developing a new skill added greater meaning to her experience on the team. The motivation and enthusiasm she felt toward the quiz was connected to the chance to develop new expertise, an opportunity she would not have had as the museum registrar.

A fourth contributing factor in Rose’s transformation was having assignments that aligned with her interests. Research has shown that having ownership of the end goal is an effective leadership strategy (Wiseman, 2010), which we found to be true as well. Having autonomy to complete a specific portion of the project that no one else was working on was extremely motivating to Rose. She explained, “I cared more. I mean, I always tried on the assignments, but. . .,” suggesting that she put more effort into assignments that were hers alone.

Providing assignments that pushed Rose outside of her comfort zone, but that were still interesting and inspiring to her, helped her develop new skills. These opportunities and the support she received helped Rose believe that she could be an effective designer, allowing her transformation to take place. This shift from more general to specific assignments benefitted not only Rose, but the entire team. Several team members became more engaged and were more accountable for completing their assignments when this modification was made.

As Rose's example demonstrates, there are several things leaders can do to help their team members be engaged in a design experience and persevere when things are challenging. Taking the time to understand the situation and the needs of the designer who is struggling will allow leaders to provide direct mentoring that is tailored to helping the individual overcome current challenges. Offering genuine praise and validation for efforts can also motivate employees. Providing opportunities to learn new skills can add diversity to work tasks and combat monotony that may lead some to disengage. Lastly, giving personalized assignments that align with their interests can help designers feel they are using their natural talents to make a valuable contribution to the team.

Model Creativity

One thing effective leaders can do is to model creativity. While it is helpful for leaders to encourage creativity, it is especially useful when they can model it, embodying this principle in their own work. The opportunity to see creativity in action can provide intellectual stimulation required for employees to develop creative solutions. Existing literature offers a myriad of suggestions of what transformational leaders can do to help their employees grow. Leaders can provide opportunities or encourage their employees to engage in discussions or activities that will offer new perspectives on familiar situations.

Yet while it is helpful to encourage such creativity and new perspectives, the literature could go farther in discussing how leaders model a creative mindset. Encouraging others to be creative is good, but the ability to actually *foster* creativity is critical in design fields. Teams need strong leaders who facilitate the creative dynamics that must exist throughout the design process. For instance, the museum's director, Daniel demonstrated this quality. He encouraged the museum's graphic designer, Nick, to make 10 versions of each design he developed. This challenge prompted Nick to reason through his choices and to be more deliberate about the designs he selected. The exercise enabled him to critically analyze the merits of his designs and have increased credibility with the team.

I found that while it is good for leaders to encourage this mindset and ability, fostering it and leading by example is even more powerful. Daniel did more than just encourage people to be creative. He also modeled this skill in his own work. He frequently considered ideas from new perspectives, linking insights from seemingly unrelated fields. For instance, he referenced his experiences with wood turning and databases when discussing exhibit design. He sought inspiration from comic books and film to improve how museum design is executed. Daniel regularly talked with his employees about new ideas he was pondering in order to glean insights that would help him develop his ideas.

For instance, he and Lydia explored the idea of creating a database that would function as Facebook for artifacts, showing profile information (e.g., an object description), details about each time it had been on display, where it is stored, etc. It would make sharing and accessing information about artifacts significantly easier than the current system allows. He also developed a conveyor system that photographs and labels archaeological artifacts that are brought back from the field, drastically reducing processing time and encouraged some of his

employees to use it. Daniel demonstrated an insatiable curiosity and desire to learn and innovate. His personal commitment to these pursuits made him a powerful leader.

Other design team managers can follow Daniel's example by modeling creativity in their own work. They can expose themselves to fresh perspectives and explore connections between the new ideas and their current projects. Involving team members in these explorations can help spread this mindset and bring other ideas to light as well. Another option is to assign team members to consider multiple solutions or design options before selecting one to develop.

Invest in Interpersonal Relationships

Building strong interpersonal relationships and effective collaboration is a high priority of transformational leaders. In this section we will discuss ways of investing in interpersonal relationships that will enhance team functioning. These approaches include structuring situations to facilitate collaboration, investing in friendships, modeling healthy conflict resolution, and teaching directly about communication.

Structuring Collaboration

In Joy, Inc., Richard Sheridan described the company culture he created in a tech company. He paired all employees with a partner to work on every assignment. Partnerships rotated periodically. As partners worked together, they were quickly able to consider multiple perspectives and resolve issues together. Through this approach, employees were quickly able to develop their skill set and resumes. Partners who were more familiar with a given technique mentored the less experienced partner. This hands-on experience helped them learn quickly and recognize how to apply the skills they learn (Sheridan, 2013).

Sheridan's approach has great value in the design world as well. Giving employees the opportunity to create together can enhance not only the products that are created, but also the

relationships between coworkers. Such interpersonal relationships are an integral part of a transformative design culture.

I found that giving team members the opportunity to collaborate on all aspects of the product strengthened their relationships, also benefitting other aspects of museum work. For instance, during the design process, Rose initiated building a prototype to test how the action of scrolling could be incorporated into the exhibit. She and Arianna colored a long strip of butcher paper that would be included in the prototype. Laughing and coloring together was bonding for them. They discussed aspects of their personal lives and provided support in these matters, not just on work projects, again fulfilling the suggestions of Gorodsky and Rubin (Kelley & Kelley, 2013). This support contributed to a safe, positive situation at work that facilitated growth. It strengthened their relationship, making it possible for work issues to be resolved quickly and easily. Because friendship was part of their work relationship, they were even more effective.

Interpersonal relationships are a key to having transformational experiences at work. Leaders can support these relationships by pairing people on assignments or by rotating team members on different projects so people can learn from and get to know each other. Encouraging joint prototyping will help people learn together. Such a task will allow team members to share their unique perspective, learn from other team members, and discover merits and weaknesses of the products they are designing, ultimately strengthening relationships and the resulting product.

Invest in Friendships Outside the Working Relationship

During my exhibit design process, the team planned to build a prototype to test what the text panels should be like, including appearance and content. Nick, the team's graphic designer, expressed,

I feel like you've gone—we're doing something that's far past what we're actually trying to accomplish. We're trying to make prototypes before we even know what we're doing. And I feel like you're not going to get any good feedback if you take it out with these ideas.

Nick's tone of voice indicated frustration and disengagement, clear signs of a negative moment in the design process. Others felt frustrated by the nature of this interaction as well. One team member stated,

I don't know that we have the kind of time that would be required for any of us to become experts in user experience design. Not that I'm saying the research isn't important and we shouldn't do it, but we aren't actually creating a social media platform. We are just emulating one so that it gives people a familiar space.

The discussion continued for several minutes until a resolution was proposed with which Nick was satisfied, which was splitting the team into smaller groups, one of which would build prototypes while the other studied social media platforms to understand the user interfaces. Although a compromise was reached, many of the team members were still frustrated after the meeting. Nick returned to his office and Jamie, Rose, and Lydia discussed the situation over lunch, attempting to determine how to support and involve Nick. While this conversation demonstrated a desire to resolve the issue and continue to collaborate, it was insufficient to resolve all of the issues. Jamie felt frustrated for the rest of the day. The following day Nick requested her assistance on a personal project and she agreed to help.

Through serving Nick, Jamie was able to completely overcome her feelings of frustration and begin to build a healthy, supportive relationship with him. Over the ensuing weeks, she spent time listening to Nick and trying to support him. Through sharing opinions with each other

over several weeks, they established a relationship of trust. As Gorodsky and Rubin suggested (Kelley & Kelley, 2013), they made efforts to have fun together. They biked and cooked together outside of work and became friends. Eventually Nick asked her for advice about how to communicate more effectively with the team. They discussed the team's interactions and brainstormed new ways of presenting concerns to the team that would allow for opinions to be expressed in a less antagonistic, defensive manner. They developed a strong relationship and worked much better together.

This situation was a transformational experience for both Nick and Jamie. It changed the way they considered the pits in the design experience. Together they noted obstacles to the sharing of ideas with the team and brainstormed ways of facilitating these discussions. They wanted to find an approach that would help all team members have a voice and feel comfortable during discussions, rather than letting decision making be dominated by stronger personalities, as was the trend. This quote by Nick illustrates the unity that Nick and Jamie developed as they worked on their relationship, which also helped them be more aware of the team's interactions and desirous to create a more unified dynamic across the entire team:

Maybe we're thinking about this all differently. Maybe we need to approach—I keep saying “we.” Maybe *you* need to approach the set up completely different. Like, throw out normality and find a new creative way to approach it that will lead to discussion.

As this quote illustrates, rather than feeling frustrated, Jamie and Nick cultivated an awareness of the needs and preferences of their colleagues. The reflection in which they engaged helped shape the team's functioning over time. They developed the ability to consider the experience of others and find ways to connect and support them rather than withdrawing. In another discussion, Nick said,

I'm an artist. I like putting things up for display. Rachel would never use something like this. She's more reading, explanation, using quotes and things like that. That's a completely different type of person. I don't think we should force people to present in an exact way, but make sure they can present in a way that people understand.

As this example demonstrates, knowing what practices to implement and avoid during difficult moments will help exhibit designers successfully navigate all aspects of an experience. Team members should consider never critiquing or making decisions during pits. Instead, it can be helpful to reflect, practice self-compassion, find ways to connect, and shift gears to do something lighthearted and playful. Conversations can reveal the underlying concerns of those involved. Taking time to listen rather than immediately trying to fix the problem can build trust and rapport. Leaders can encourage and model these behaviors to build supportive relationships that, in turn, give designers confidence to express their ideas.

Model Healthy Conflict Resolution

Shortly before the de-installation phase, Nick felt the team was stuck and needed to make several decisions. He requested to have an impromptu meeting and asked Jamie to inform Rose. She responded uncharacteristically curtly. In her hurry, Jamie did not take much time to consider Rose's response and assumed she wanted to be alone. Jamie went about her work but noted that Rose seemed aloof the rest of the day.

The following day, Rose texted Jamie to explain her previous behavior: she wished Jamie had been more responsive to her and had taken the time to understand her reaction. Through a few texts, they were able to resolve the situation. The understanding they gained through this communication ultimately strengthened their relationship. In it, they practiced expressing their

feelings and validating each other's experiences. This interchange reaffirmed how much they valued each other and left them both feeling more secure in their relationship.

Previous to this experience, Jamie felt hesitant about resolving conflict with others due to fear of how they would react. Bolstered by this experience, Jamie attempted to resolve another concern with Lydia in a similar manner. However, the situation was not resolved as she'd hoped it would be and she was left feeling invalidated and uncertain about what to do. Finally, after the project's completion, Lydia approached Jamie and addressed the situation. In the end, Jamie felt more secure in their relationship. Through talking with Daniel about the experiences, she learned more about approaches to resolving conflict and felt more confident and able to do so in the future. She became more thoughtful about her approach to addressing concerns and has since noticed improvement in the quality of her relationships with others.

As Jamie's experience shows, interpersonal interactions are another area in which individual designers can be transformed. One of the biggest influences in her development was Rose's example in addressing conflict. Rose made herself vulnerable by expressing how she felt, trusting that Jamie would care and validate her efforts. Jamie was able to follow her example and muster the courage to express her own concerns. Having a positive example and opportunities to practice helped Jamie develop greater abilities to address conflict with others; she was motivated to keep working to develop these skills.

To support growth like Jamie's, leaders can model vulnerability in their conversations with the team members. They can also teach about and model effective conflict resolution. More specific ideas on this subject will be presented in the following section on transformational leadership.

Teach About Communication

Effective leaders keep lines of communication open. In his Transformational Leadership Theory, Bernard Bass (1985) suggested one component of this leadership style is individualized consideration, meaning leaders should foster supportive relationships by keeping the lines of communication open so followers can share their ideas and receive direct recognition for their contributions.

We found that more than just allowing for communication to happen, transformational leaders also teach explicitly about communication. As a transformational leader, Daniel taught about communication styles. Referring back to the conflict resolution situations Jamie experienced, direct mentoring from Daniel helped her become a more effective communicator. After the exhibit was installed, Daniel spoke with Jamie about her experiences with conflict resolution. Using his understanding of all of the team members involved, Daniel taught Jamie how to consider her communication approach and how to adapt it to meet the preferences of different people.

Daniel was able to function as a transformational leader in this way because he was diligent about observing and getting to know his employees. The understanding he developed through these efforts allowed him to exert powerful influence on people. Like in the discussion with Jamie about conflict resolution, Daniel listened to his employees voice their concerns, including issues in their personal lives, and then presented new ways of considering situations. On many occasions, as in his interaction with helping Rose re-engage with the team, he helped his employees gain new perspectives that change their course of action for the better. He was a great example of how transformational leaders both teach about and model effective communication.

Conclusion

In this article, I share what I believe are key principles that leaders can implement to help transform the design culture within their design teams. These principles can be categorized as first understanding the relationship between designers and their ideas, and how this affects team relationships; building relational design capacity in team members; building creative potential in team members; and improving the team design climate and connection among team members.

As the vignettes presented in this article demonstrate, there are many principles exhibit design team leaders can use to support their teams. Research in leadership and creativity provide valuable insight into certain aspects of design cultures. Our reflections build upon what extant literature shows about these topics and combines them with our own reflections to illustrate how to deliberately design an effective collaborative work environment. When individual designers develop awareness of how they and their teammates respond to various situations, are supported by their leaders, and establish strong personal relationships with each other, dramatic changes may result. Through the collaborative process of design, they participate in not only creating a new product, but also in their own transformational experiences and the development of new skills among their team members.

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DISSERTATION CONCLUSION

Through the articles contained in this dissertation, I have sought to explore and clarify the museum exhibit design process and offer practical suggestions for improvement in this realm. In Article 1, I reviewed existing literature to reveal what is currently known about the design process and identify gaps in understanding of how this field functions. Through Article 2, I looked more specifically at how exhibit designers use visual representations to communicate their ideas and how the use of visuals influences the team dynamics at play. In Article 3, I offered suggestions for how to support the professional development of individual exhibit designers and the interpersonal relationships that exist on design teams. Through exploring these topics in this dissertation, I hope to have helped make the exhibit design process clearer for individuals who are entering this field with little to no prior experience, as well as to other interested parties. I hope the themes discussed and practical suggestions are useful to professionals in the field in being more deliberate about the way they communicate and interact, which could strengthen their teams.

More carefully considering the issue of exhibit design (and companion issues like the processes used to structure the process and communication patterns) can make a powerful practical difference among museum exhibit design practitioners. Exhibit designers may perform their work unreflectively and therefore miss out on opportunities to innovate and improve the experience. The findings presented in these articles could help these practitioners to reflect on their design practices and relationships with colleagues, potentially leading to stronger collaboration and more innovative exhibits. This would result in practitioners who are better equipped to tackle ambiguous design challenges in a flexible way, while smoothly navigating the ebbs and flows in relationships with colleagues.

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APPENDIX A

Qualitative Method Description

At the time of this study, the lead author was the exhibits manager at a student-run museum and led teams that planned new exhibits. During this study, she participated as a design team member and engaged with the designers as a participant observer. To guard against potential bias in the study, she invited her committee chair to check her field notes. She counseled frequently with the museum director about his observations.

The remainder of the appendix includes the interview protocols for the semi-structured interviews conducted for the study.

First Interview

This interview was conducted two months after the beginning of the design process to allow time for them to gain experience and create several visuals. To understand how design teams use visual representations to develop and communicate ideas, we used the following list of questions to guide my semi-structured interviews:

- What is your involvement in the design process?
- What resources do you have for making visuals?
- How accessible are these resources? Does that affect how likely you are to create visuals?
- Do you have any artifacts or copies of artifacts (sketches, storyboards, prototypes, etc.) that you would be willing to share with me so I can understand your work better?
- Describe how ideas develop and emerge as you collaborate with others. Do you keep track of this evolution? If so, how?
- How did ideas on this topic evolve during the course of the project?

- What questions were you trying to answer through each visual?
- What answers did you get through the visuals you created?
- What types of visuals are especially useful to you in the design process? Not useful? Why?
- What constraints did the visual introduce or help you consider?
- What pre-established ideas or expectations did you have (personally or as a group) that you compared to the visuals you created? Did these ideas affect the number or type of visuals you created?

Second Interview

This interview was focused on the exhibit they were designing and the visual representations used in the process. During this interview, we used the following interview protocol to guide my discussions:

- Who did you make the visuals for? Did you use visuals differently by yourself than with the team? Did you create them differently? If so, how so?
- What visuals did you create outside of design meetings?
- When and why did you create them? What did you do with them?
- Were there portions of a specific idea that were not recorded visually?
- (If groups create visuals together) How did this activity transpire?
- Were some visuals more helpful at certain times than others? (Other times? Other visuals?)
- Can you think of any examples of when a visual helped you have a new idea? Or consider a concern or issue you hadn't considered before?

- How are you constrained in making visuals (physical space/environment, socially, materials)? What is the limiting factor?
- What effect did the visuals have on your team's ability to negotiate?
- How did using visuals help you understand the people on your team who have backgrounds that are different from yours?
- What issues did visuals reveal that you hadn't considered before?
- Can you share an example of how a visual helped clarify things or focus your thinking?
- Did you use/interact with a single visual differently than with a series of visuals?
- In terms of considering visitor needs: what was most impactful? (e.g. visitor studies results, education team, or a visual--storyboard, model, etc.)
- When and why would you use: a sketch, storyboard, prototype, bodystorming?
- What information is stored in a visual? Why is it important for this info to be stored?
How do you use it in the future?
- What decisions were made based on the visuals?
- Do you receive encouragement to make visuals?
- How did the visuals mediate group interactions?

Trustworthiness

We followed trustworthiness standards described by Lincoln and Guba (1985). They presented four criteria for ensuring the trustworthiness of the study, including credibility, confirmability, dependability, and transferability. Below we describe how we met each of these standards.

Credibility. Credibility standards ensure that the participants of the study feel that their perspective has been properly represented in the data that is collected. This standard can be met

through practices such as prolonged engagement, persistent observation, negative case analysis, member checks, the inclusion of emic perspectives, and progressive subjectivity checks.

Prolonged engagement was ensured through attending the majority of design team meetings during the exhibition development. Being present through the entire project allowed me to build a relationship of trust with the participants and experience variations that took place in the process. We were able to note the relationships that existed between team members and their colleagues, as well as the visuals they created. We observed a close connection between many of the designers and the visuals they presented to the team, which influenced how the team interacted.

Persistent observation was achieved through in-depth analysis of the data collected in the study. Early in the study, we recorded everything we knew about each team member and details of our relationships, thus demonstrating my personal perspective on the study. We analyzed the data gleaned from team meetings, as well as the visuals that were created throughout the entire process and kept records of details of the visuals in a database. Later this information was triangulated with the interviews to understand the influence visuals had on the material culture of the design team. This provided a greater depth of understanding, which we used to present a credible and accurate description of the ways designers use visual representations.

Negative case analysis was used to identify situations that were different from the rest and to discover new themes that arise in the study. This helped me refine my conclusions further by prompting me to reevaluate the themes we identified. As we analyzed the data, we looked for situations that occur which are outside the norm. Examples may include: visuals used in unexpected or even detrimental ways, ways we expected, factors that encourage creativity and communication, and obstacles that hinder exchanges. For instance, one team member made few

visuals compared to the other team members and we were able to understand more about her experience by considering why she differed from the others. This analysis revealed an important theme about self-efficacy and the impact it has on how team members interact.

Member checking was done to ensure that participants know that their perspectives are portrayed accurately in the results of the study. They were invited to confirm or adapt what we wrote to ensure they were correctly represented. These checks were done during thematic analysis and after we wrote our findings. Member checking also made it possible to ensure that the emic perspective is present in the results.

Progressive subjectivity checks were recorded to describe my evolving thought about the study. These checks ensure that we did not get stymied in my approach toward thinking about the data and that we did not only find what we originally expected to find. We maintained records of our developing thinking in my audit trail. We specifically included things that surprised us or that did not fit with our expectations.

Confirmability. Confirmability was achieved through establishing that the results are in line with extant literature and the degree to which they are confirmed by participants in the study. To meet this standard, we became familiar with the literature on the forms of visual representation we studied, as well as verbal-visual communication. We also referenced museum exhibit design manuals. As other topics arose throughout the study, we consulted the literature and museum administrators to certify the confirmability of my findings.

Dependability. The dependability standard requires that there is consistency in the research process throughout the life of the study. This standard was met through frequent checks by the director of the museum. We discussed the study on a weekly basis and on several occasions, he provided insight that influenced my thinking about the experience. The doctoral

committee chair was invited to do dependability audits throughout the study. It was also increased by providing a description of why participants were selected and through keeping field notes, an audit trail, and a record of our evolving thinking. We also regularly reviewed the notes we took as a way of developing new insights (Williams, 2011).

Our field notes included brief notes taken during observation, interviewing, participating, etc. These notes about specific design meetings were augmented by the video recordings we made. After each data collection experience, we expanded our notes to include more details and connections or trends we observed. Each entry was labeled with the date and location the notes were taken. Changes in event or speaker were noted.

We kept a research journal, in which we included descriptive field notes and reflective field notes. The descriptive field notes include descriptions of what we saw, heard, and experienced. Descriptions of relationships with the participants were included, as well as any information we knew about them. We also documented the physical setting in which the team worked and the events that took place. To augment the descriptive field notes, we included reflective notes that detail my speculations, feelings, ideas, biases, and connections (Williams, 2011).

Transferability. Transferability refers to the ability to transfer findings from one context to another. Findings from this study should be useful to exhibit designers in a variety of museums, as well as designers in other fields, so the transferability of the data is very important. To facilitate other designers applying the findings to their own situations, we included a description of the context of the museum and design team. We also included thick, rich description by including quotes from participants. This should enable readers to determine the usefulness of the findings in other settings.

APPENDIX B

Consent Form

Consent to be a Research Subject

Introduction

This research study is being conducted by Jacquelyn Johnson, a PhD student at Brigham Young University to determine how museum exhibit designers use visuals (sketches, storyboards, prototypes, and bodystorming) during the process of designing new exhibits. You were invited to participate because you are a member of the exhibit design team at the BYU Museum of Peoples and Cultures. As such, you will have valuable experiences using visuals that you can share with the researcher.

Procedures

If you agree to participate in this research study, the following will occur:

- The researcher will attend and record design team meetings. She will take notes about her observations during the meetings. These meetings will last approximately 1 hour and will take place once a week for 16 weeks.
- You will be interviewed twice during the design project, once approximately halfway through the process and once at the end. These interviews will last between 45-60 minutes and will be about how you use visuals as you design and how they help you explore ideas and make decisions.
- The interviews will be audio recorded to ensure accuracy in reporting your statements. The researcher may also take notes during the interviews.
- The interview will take place in the researcher's office at a time convenient for you or it will take place at a time and location convenient for you.
- The researcher will contact you later to clarify your interview answers.
- Total time commitment will be anywhere from 90-120 minutes.
- You are welcome to discontinue the interviews at any time.

Risks/Discomforts

There are minimal risks associated with participation in this study. You will be interviewed while still on the clock at work, so participating should not take up any extra time beyond what you would be spending at work. The interviews may temporarily take you away from other work projects. You may feel some discomfort in being interviewed by a coworker about your design practices. If you do feel uncomfortable, you may choose to decline to discuss the topic or excuse yourself from the study.

Benefits

There will be no direct benefits to you from participating in this research except that you may appreciate knowing that someone values your opinion about your experiences on the team. These interviews can also be a way to provide feedback to the researcher about your experiences with collaborating on a design team. It is hoped that through your participation we will learn more about how visuals are used in exhibit design so that improvements can be made to the process, which will benefit employees in the future.

Confidentiality

The research data will be kept on a password protected computer, and only the researcher will have access to the data. At the conclusion of the study, all identifying information will be removed and the data will be kept in the researcher's locked cabinet or office.



Compensation

There is no monetary compensation for your participation in this study.

Participation

Participation in this research study is voluntary. You have the right to withdraw at any time or refuse to participate entirely without jeopardy to your employment at the museum.

Questions about the Research

If you have questions regarding this study, you may contact Jacquelyn Johnson at 860-595-8527, jajo37@gmail.com or Rick West at 801-422-5273, rickwest@byu.edu for further information.

Questions about Your Rights as Research Participants

If you have questions regarding your rights as a research participant contact IRB Administrator at (801) 422-1461; A-285 ASB, Brigham Young University, Provo, UT 84602; irb@byu.edu.

Statement of Consent

I have read, understood, and received a copy of the above consent and desire of my own free will to participate in this study.

Name (Printed): _____ Signature _____ Date: _____

