Theatrical Productions and Digital Technology

Innovations in and Implications of Digital Production Technology in Regional Theatre

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Master's Research Project

Spring 2011

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Presented to the Arts & Administration program of the University of Oregon in partial fulfillment of the requirements for the Degree of Master's of Science in Arts Management.

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Approved: _____

Dr. Lori Hager
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Date: 6/04/2011

Acknowledgements

I would like to thank the faculty of the University of Colorado at Denver's Department of Theatre for fostering and developing my skills as a theatre professional and for giving me the confidence to follow my dreams. In addition I would like to thank the faculty of the University of Oregon Arts Administration Program for taking my passion for theatre and transforming it into a professional skill set that will make my dreams a reality. I would also like to thank my research advisor Lori Hager whose steady, enthusiastic and inspirational guidance helped me accomplish the body of work that follows. This work could also not have been possible without the help the staff at the Denver Center Theatre Company.

I am pleased to produce this work in the company of such an accomplished cohort of emerging leaders. I am excited to see the amazing work that we will undoubtedly create in the art world. Finally, I would like to thank my family for giving me the drive to accomplish my goals, and the support I needed along the way. Without their support my career in the arts would not be possible.

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EDUCATION

M.S. Arts Administration *Performing Arts Focus*, Nonprofit Management Certificate
University of Oregon, Expected Graduation June 2011
B.A. Theater, Film, Television *Direction and Production Emphasis*, Minor in History
University of Colorado at Denver, Graduated May 2006

EXPERIENCE

Board Member, *Lord Leebrick Theatre Company* September 2010 – present
- Served on event committee planning annual fundraising event. Developed capital campaign strategy.

House Manager & Marketing Assistant, *University Theatre* September 2010 – present
- Developed & bolstered social media marketing efforts, and updated marketing databases
- Ensured front of house operations ran smoothly, and patrons problems were addressed

Program Coordinator, *Willamette Valley Music Festival* January 2011 – present
- Booked 10 acts for secondary stage, and organized 3 new song competition

Event Coordinator, *Cinema Pacific Film Festival* January 2010 – June 2010
- Organized gala party (100 plus guests) for opening night of Cinema Pacific Film Festival

Stage Manager, *Curious Theater Company* October 2005 - June 2009
- Ensured actors were informed and adhered to Equity (union) rules and regulations
- Organized meetings between producers, director, designers and production staff

Lighting/Electrics/Run Crew, *Arvada Center for the Arts & Humanities* September 2007- August 2009
- Hang, focus, program lights for over twenty theatrical performances
- Ran technical aspects (lighting, sound, deck, properties) for special events and performances

Production Assistant, *Opera Colorado* September 2007- May 2009
- Collect tax information and identification from crew members

INTERNSHIPS

Company Management Intern, La Jolla Playhouse June 2010 – August 2010
- Prepared artists contracts, travel, housing and other arrangements during residencies

Community Events Intern, City of Eugene Library, Recreation, & Cultural Services January 2010-June 2010
- Assist in researching, contracting, and booking acts for Summer in The City (10 weeks long) event series
- Assist in development of marketing plan for Summer in The City event series

SOFTWARE

- Microsoft Office (word, excel, power point), WordPress , Adobe Illustrator, Indesign, Photoshop, Dreamweaver
- Hog 1000 and Hog IPC Lighting Consoles

See page 2 for Production History

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PRODUCTION HISTORY

Position	*Production*	*Year*	*Organization*	*Director*
Deck Run Crew	*Big River*	July 2009	Arvada Center for the Arts	Stephen Bourneuf
Stage Manager	*26 Miles*	May 2009	Curious Theatre Company	Pesha Rudnick
Light Board Operator	*Just So*	February 2009	Arvada Center for the Arts	Edith Weiss
Purchasing Agent	*2008-2009 Season*	October 2008	Opera Colorado	Ron Daniels
Property Design	*Speech and Debate*	September 2008	Curious Theatre Company	Dee Covington
Deck Run Crew	*Seussical the Musical*	September 2008	Arvada Center for the Arts	Nick Sugar
Light Board Operator	*Buddy…The Buddy Holly Story*	July 2008	Arvada Center for the Arts	Rod Lansberry
Assistant Stage Manager	*The Denver Project* *	May 2008	Curious Theatre Company	Dee Covington
Light Board Operator	*A Year with Frog and Toad*	March 2008	Arvada Center for the Arts	Dave And Julie Payne
Assistant Stage Manager	*Heather Raffo's 9Parts of Desire*	February 2008	Curious Theatre Company	Penny Wrath Cole
Spot Light Operator	*La Cage aux Follies*	November 2007	Arvada Center for the Arts	Rod Lansberry
Light Board Operator	*Miss Nelson Is Missing*	October 2007	Arvada Center for the Arts	Edith Weiss
Assistant Stage Manager	*How I Learned to Drive*	Sept 2007	Curious Theatre Company	Chip Walton
Stage Manager	*A Lesser Life* *	June 2007	Arvada Center for the Arts	Christy Montour-Larson
Stage Manager	*Squall*	April 2007	Modern Muse Theatre Company	Billie McBride
Assistant Stage Manager	*A House with No Walls*	February 2007	Curious Theatre Company	donnie l. betts
Assistant Stage Manger	*tempOdyssey**	October 2006	Curious Theatre Company	Chip Walton
Assistant Stage Manager	*Fiction*	May 2006	Curious Theatre Company	Jamie Horton
Production Intern	*Gem of the Ocean*	January 2006	Denver Center Theatre Company	Israel Hicks
Assistant Stage Manager	*Bug*	October 2005	Curious Theatre Company	Chip Walton
Director	*Macbeth*	August 2005	UCD Theatre Buffs Production	Kelly Johnson
Stage Manager	*Antigone*	February 2005	Kennedy Center American College Theater Festival (UCD)	Laura Cuetara

* *world premier*

Abstract

The purpose of this master's research project is to explore the changes taking place in modern American theatre, through the lens of digital innovations in production technology. The central question of my research is to explore the ways that digital technology is being incorporated into modern theatrical productions. Using a review of literature, document analysis, a survey, and a case study I examine the variety of technologies available, how they are integrated, and the resulting impacts on design, production, administration and technology in regional theatre.

Keywords

- Regional Theatre
- Digital Technology
- Productions
- Integration
- Innovation
- Liveness

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Chapter One | Introduction

1.1 Problem Statement

Technology is rapidly changing the environment in which we live. All fields of study adapt to technology, constructing new and innovative ways to use technology to improve business operations. Recent developments and enhancements in digital technologies have altered the ways that many individuals and businesses function. With current technologies, the collection and distribution of information can be accomplished at lightning speeds, in almost any location, and within a global network. This constant connection has created, as Moltenbrey (2003) describes, a "current generation that is hardwired to process multiple streams of dynamic visual information almost instantaneously" (p.4). Constituents of the 21st century workforce have realized that a command, and knowledge of digital technologies has become a required skill for success. As technology changes the ways that we function in society, it is imperative that we adapt and integrate new technologies to best serve our respective fields (Court, 2007).

Theatre is no exception to the current technological revolution. As competition for leisure time increases, it is important to find new approaches for engagement and creativity in theatrical productions in order to make connections with digitally saturated audiences. Expectations from audience members, designers, directors, artists and administrators have changed due to the progression of digital technology. It is critical that the next generation of theatre leadership be aware of current digital technologies and their uses, be able to navigate their meaning, and examine their impacts. As explained in *Perspectives on Technology and Work Organization*, "Technology's impact on work is contingent on a broad set of factors, including the reasons for its introduction, management philosophy, the labor-management contract, the degree of a shared

agreement about technology and work organization, and the process of technology development and implementation" (Liker et al., 1999, p.578).

As the production technology landscape shifts, an adaptive and enlightened community of theatre artisans are crafting engaging and innovative productions for a new age by acknowledging shifting patterns through embracing new technology. In order to engage with modern audiences, the relationship between digital technology and theatre needs to be examined and addressed. Theatre artists have the capacity to unleash the creative potential as well as increased efficiencies provided by new technology. As Dixon (2007) declares, "Theatre has always been an integrative, collaborative art which potentially (and sometimes actually) includes all art….why not claim interactive art in the name of theatre" (p.3). The variety of both legacy and new digital technology that is available for theatrical productions creates a wide spectrum of ability levels in use and implementation.

As Court (2007) outlines, "the skills required in theatre are not shifting from older to newer technologies so much as they are expanding to include both" (p.43). Within the arts, it has been demonstrated that digital technology can be used as a powerful tool in the creative process, opening new worlds of possibility. Describing this marriage between technology and performance, Looseleaf, (2007) states that "the last twenty years have allowed designers to incorporate technology into storytelling without solely having to rely on performers" (p.50). Leaders have the opportunity to implement innovations in technology in order to complement and enhance the creativity of productions and help fulfill their organizations mission.

1.2 Purpose Statement and Research Questions

The purpose of this research is to examine digital technology innovations and integration approaches in theatrical productions occurring in regional theatres in the United States. This

research identifies and highlights trends and issues in technology facing 21st century theatre. It demonstrates how integration methods and production advancements are incorporating technology to increase efficiencies as well as expand the creative possibilities of the art and process of theatre-making. Research in uses and impacts of emerging digital technology within theatrical productions will provide a creative framework to examine how technology is reshaping theatrical processes and creating new experiences in live performance. The function of digital technology within theatrical productions has a direct implication for design, production, and administrative professionals in regional theatre. This research asserts that organizations, administrators, and designers need to develop and communicate dynamic decision making protocols toward technology as the art of theatre-making continues to adapt to digital technology. Chatzichichritodoulou (2009) believes that, "a myriad of aesthetic, experiential and interdisciplinary opportunities are offered by contemporary performances that 'dare' interact with an 'other' system of disciplines by integrating technologies into their practice" (p.1).

To date, there is minimal comprehensive research on the status of innovation in theatre technology. This is an investigation of recent developments and innovations in theatre technology, including integration processes and resulting impacts, which will be a useful resource for arts administrators and theatre professionals. The themes that initiated my research and review of literature include an exploration of how digital technology and traditional (or legacy) elements of technical theatre are being mixed together to create new production technologies and industry standards (Court, 2007). My desire to explore technology and modern theatre resulted in a main research question and several sub-questions:

Question: How are regional theatres integrating digital production technologies into performances?

Sub-questions include: What are the new digital technologies (products and trends) being developed and implemented in regional theatre?

How are new digital technologies being integrated into facilities?

How are new technologies impacting training for theatre professionals (university training as well as professional development)?

How are these innovations impacting theatre as an art form?

I examine what emerging technologies are currently being developed for use in theatrical productions. In order to explore new innovations in digital theatre technology I divided theatre technology into the three most technologically driven areas: scenery, lighting, and projections. My conceptual framework maps my initial concepts and illustrates my thought process about the ideas and themes that emerged for my initial question.

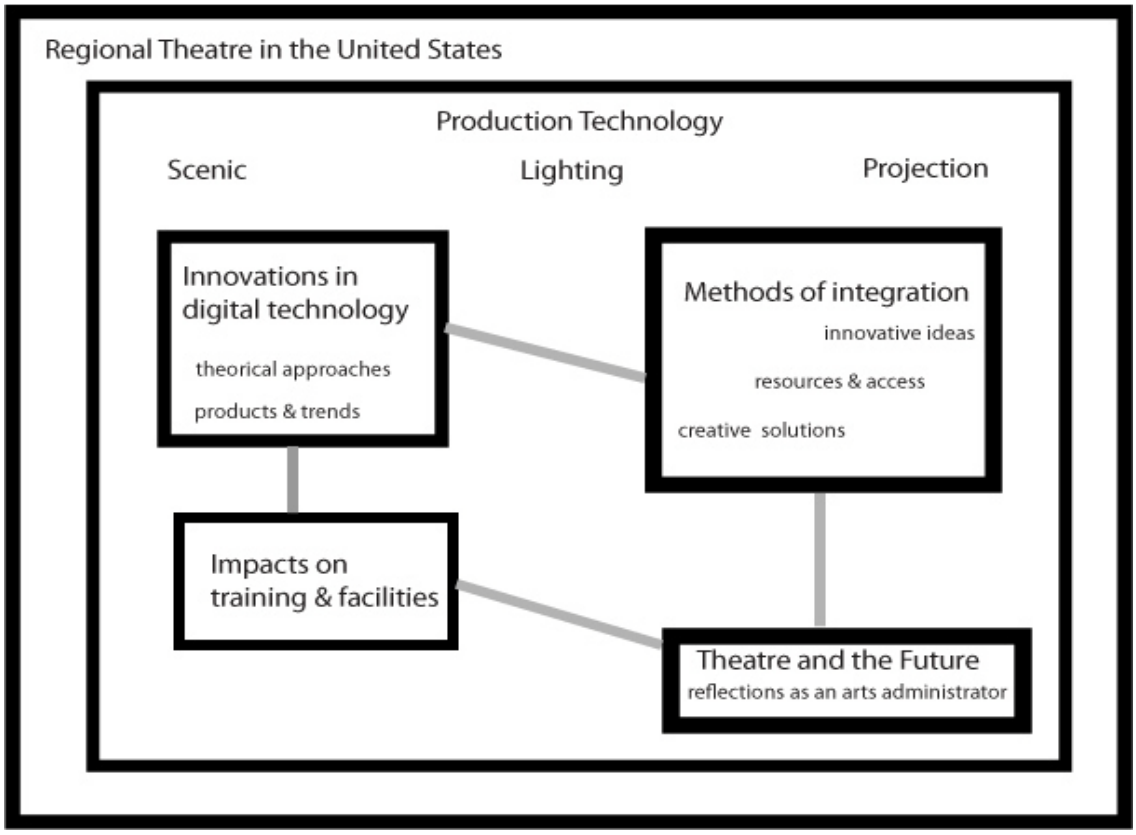

Figure 1 Conceptual Framework

1.3 Definitions

The following definitions were crafted through my review of literature and are consistent with industry use and understanding. These definitions are articulated in order to provide clarity to the assumptions made by this research.

Digital Technology: There are many ways that technology is applied within theatre and therefore many definitions of what 'new' stage technology might include. Dixon's (2007) definition of digital performance asserts that digital computer technology "plays a key role rather than subsidiary one in content, techniques, aesthetics or other delivery forms" (p.3). I will use this statement as my description of digital technology.

United States Institute for Theatre Technology (USITT): USITT is the national service organization devoted to theatre technology. They host an annual trade show and conference that "disseminates information about the history of the field, and aesthetic and technological developments" (United States Institute for Theatre Technology, 2010a).

Regional Theatre: In the realm of theatre the term "resident" and "regional" are used interchangeably to describe the nonprofit theatres that developed beginning in the 1960's all over the country. They range in size and budget, and have prominence in the communities they serve. Many are members of service organizations like TCG and LORT (see below).

Theatre Communications Group (TCG): TCG is a professional association that works to "increase the organizational efficiency, cultivate and celebrate the artistic talent and achievements of the field and promote a larger public understanding of, and appreciation for, the theatre" (Theatre Communications Group, 2010).

League of Resident Theatres (LORT): LORT is a professional theatre association focused on communication and relations between community interests and the general welfare of theatre (League of Resident Theatres, 2010).

1.4 Delimitations

To narrow the scope and provide more specific results I have placed the following restrictions on my research.

- Geographic: United States
- Organization Type: Regional Theatres (with membership to one of the following professional service organizations: TCG or LORT).
- Production Technologies: This research only explores scenic, lighting, and projection production technology.

1.5 Limitations

I have created a research approach and scope that takes my time limitations into consideration to ensure that I had time to complete the tasks I aspired to accomplish. While having a narrow scope makes the research attainable within my time restrictions, it only presents the data in relation to regional theatre. A robust and holistic project might include a comparison with for-profit counterparts. In addition I do not attempt to explore or measure audience reaction to new technology. I recognize the importance of audience input to the process of theatre-making, but it is not directly addressed in this study. I have clearly defined the scope of my research in ordered to demonstrate that information in other fields will not be addressed.

1.6 Methodological Paradigm

The ways in which individuals receive knowledge and data impacts the ways they interpret and engage with information. The manner in which I receive knowledge is reflected in

my approach to producing knowledge through this research. I value the complexities of the universe and always challenge myself to examine information or situations from different angles. My research is approached from a relativist philosophy or paradigm. In this position, "there are no universals and things like truth, morals, and culture can only be understood in their own socio-historic context" (O'Leary, 2010, p.6). This research will provide information about technology for individuals to use as it fits their needs. The methodological approach that best matches the content of my research is ethnomethodology. In this framework, the research focuses on uncovering rules, and examining interactions that affect the world around us (O'Leary, 2010). Ethnomethodology is typically supported by qualitative data collection methods, but I have enlisted both qualitative and quantitative data collection techniques.

The methods that I have used to collect information are document analysis of conference materials, an informational survey, as well as an in-depth case study of one regional theatre. Applying each of these tools is the most effective, responsible, and meaningful way to collect data for this research. As I approach my research in an exploratory framework rather than an action or answer driven way, information that is descriptive will create a cohesive understanding of the topic. In addition to my descriptive data, my use of survey will provide some quantitative data that will enhance the other evidence that I have collected.

1.7 Research Approach

My research approach includes a review of literature (including document analysis), attendance at the United States Institute for Theatre Technology (USITT) conference, an informational survey, and one in-depth case study to survey and collect information. I have combed through professional journals and magazines, in order to get at the core on what is happening in the field of technical theatre. According to O'Leary (2010), document analysis

includes, “collection, review, interrogation, and analysis of various forms of written text…” (p.223). Analyzing these documents allowed me to identify themes and to discover what technologies are currently being used in theatre. I implemented document analysis techniques in analyzing these documents, as well as the materials gathered at my attendance at the USITT conference and trade show. This conference supplied me with firsthand knowledge of the innovations being made (through product demonstrations) and how they are being used and who is using them (through attendance at a variety of panels). I developed a document analysis worksheet which helped me record, document, and code my findings (see Appendix A). My coding system consists broadly of three categories: Innovations, Integration, and Impacts.

I created and distributed an informational survey (see Appendix D) online through surveymonkey. The survey was sent to approximately one hundred regional theaters throughout the United States. It was designed to discover what (if any) trends are occurring in the use and integration of theatre technology. I recruited participating organizations via email (see Appendix E). The survey was sent to technical directors, production managers, and artistic directors as these staff members have the most information about the organizations experience with and use of digital technologies with their productions. The survey was designed to compare a variety of regional theatres in order to produce more universal results.

In an effort to triangulate my findings I also conducted one in-depth case study, examining the Denver Center Theatre Company. The same criteria were utilized to select this specific theatre as was to select participants to take part in my survey. Exploring an individual theatre’s uses of technology provided detailed information that was not uncovered through the survey results. Theatre-makers are very innovative, and are experienced in creating new worlds

with limited resources. This research discovered some of the creative ways that digital technologies are being used and what future uses are being unveiled.

1.8 Case Study

The purpose of the case study is to examine how one regional theatre is exploring the possibilities presented by digital technology and how they are implementing these ideas. The Denver Center Theatre Company (DCTC) is a prominent regional theatre that has demonstrated a growing interest in the function of technology within theatre. They are one of the few theatres in the country that have a full time media specialist on staff, who has freedom to explore what technology means to the organization. The DCTC has received grants from organizations like EMC Arts, whose focus is on encouraging innovation. Within this case study I reviewed organizational history, mission and programming, interviewed both production and artistic administrative staff members, explored technologies used, inquired about facility capacities and more.

Key Informants:

Charlie Miller | Resident Multimedia Specialist

Josh Prues | Assistant Technical Director | Head of Automation

Charles MacLeod | Director of Lighting

Kent Thompson | Artistic Director

1.9 Data Collection

The central research question of this study is how regional theatres are integrating digital production technology into performances. As discussed in my research design, I used document analysis, a case study, and a survey as strategies of inquiry. I have created and used several research instruments to help guide and focus my analysis of the data collected. The document

analysis worksheets that I created helped me track important themes as well as understand the context in which the documents were written to help check biases. Short summary descriptions of the documents that I found allowed me to easily retrieve information. I stored documents and analysis worksheets within a research binder.

Researching case studies and quantitative analysis (for my survey data) ensured that I collected and analyzed the data in a manner that is consistent with other researchers in the field. After receiving consent, I recorded and transcribed interviews, which were conducted by phone, due to the distance. The audio recordings were then destroyed. I stored all information gathered during my case study on my computer which is password protected. If consent to use names was not given, I provided code labels, using the title of the participant (i.e. one, two, etc.).

My survey was conducted online through the surveymonkey website, and was sent via email to a selected list of participants. The first question contained a prompt that outlined consent and provided an option to continue, or forego participation. Names were not required; instead I asked for their job title. I implemented the above procedures in order to provide participants with transparency of methods, and to create a comfortable atmosphere in which to provide honest answers.

1.10 Organization of Study

This study is has been divided into the review of literature, presentation of data, analysis, and summary and discussion. The review of literature contains information on theories addressing technology and theatre, innovations in scenery, lighting and projections, and how technology is changing training and impacting facilities. The presentation of data shares all data collected through my survey and case study. Then in the analysis, I triangulate the information

from the review of literature, survey and case study to address my research questions. In the summary and discussion connect my findings to the future of regional theatre in America.

Chapter Two | Review of Literature

In an article discussing the relationship between theatre and technology Moore (2010) asks whether, "Technology is threatening to pull the plug on live theater as we know it. Or perhaps it promises to 'plug in' the next generation" (para.1). I scanned a variety of sources to help get a sense of how artists feel about the integration of digital technology into the field of regional theatre. In addition to helping me explore ideas and theories about digital technology and art, my review of literature and conference participation allowed me to identify the current technologies available in the areas of scenery, lighting and projection. The final section of the review of literature examines how these technologies can, or will, impact training and facilities.

2.1 Theory

Technology & Art

With its roots in ancient Greece, theatre is an art form based in tradition, social commentary and reflection. The earliest recorded dramatic theory *The Poetics*, written by Aristotle, indentified six main elements of drama: plot, character, thought, diction, melody, and spectacle. Each of these elements come together to create and enhance storytelling. The element of spectacle involves using technical elements to enhance storytelling, elicit emotions, and add to the general awe of the experience (Aristotle et al., 1995). The environment created around the performer using lightings, sets, costumes, and sound has been an integral part of theatre making since the time of Aristotle. Modern theatre-makers are infusing this ancient art form with new digital technologies to create spectacle that will resonate and connect with modern audiences. There have been many theories developed that address the relationship between art and technology (Murphie & Potts, 2003). The theoretical framework that this research best encapsulates is technological determinism. Technological determinism refers to the "belief that

technology is an agent of social change" (Murphie & Potts, 2003, p.11). Advances in digital technology are changing the way we function in society which, in turn, adjusts our expectations and experiences.

This is not an altogether new phenomenon, as innovation in technology has been a driving force of societal change throughout time, but it is the current rate of change that characterizes modern progress. Accelerating change theories suggest that there is a supposed increase in the rate of technological, and therefore social and cultural progress throughout history (Anderson & Tushman, 1990). Change is happening fast, and how quickly we adapt and adjust to technology is important to the types organizational structures created. Investigating the relationship between art and technology has provided an opportunity to critically examine the ways that technology and innovation are changing the art and process of making theatre, as well as audience expectations. For example, a Cirque du Soleil production, *Ka*, spent over 165 million dollars to create a visual spectacle that was operated by over 30 computers and 40 workstations (Looseleaf, 2007). The scale of the productions in regional theatre would not be as grand, but audience expectations are being crafted by these types of blockbuster productions.

The selection of technology used and how the viewer receives it, is a significant part of the design process and technology integration. McLuhan (1964) theorizes that, "the personal and social consequences of any medium-that is, of any extension of ourselves-result from the new scale that is introduced into our affairs by each extension of ourselves, or by any new technology" (p.7). Technology is a tool that artists have employed to enhance the creativity of their work, in some ways becoming a separate work of art in itself. Looseleaf (2007) explains that within productions there are "two shows going on: the artists' and the technology behind the scene" (p.49). In a society driven by quickly changing technology, creative professionals should

consider how the vision of the artist and the developments in technology can blend together to communicate the story. As with many industries, digital technology within the theatre is successfully implemented with a focus on the balance of legacy and emerging tools, and gradual integration of these new tools. Technology has the power to shift cultural frames of reference and it is important to know how to incorporate new systems responsibly for both artists and audiences.

Liveness & Theatre

Auslander (2008) encapsulates the impetuous for this research by stating, "my interest in the cultural status of live performance derives directly from my sense of living in a culture in which something I continue to value seems to have less and less presence and importance" (p.4). The role of live performance in our society is changing, but theatre is an adaptable form, which has transformed throughout the ages to ensure its survival. As new digital technologies are being integrated into performances to address this cultural shift, we must ask ourselves, what message are we transmitting to our audience through the use of digital technology in our productions? A review of the literature reveals how the integration of digital technologies into live theatre is managed and dichotomies in the reactions about its use. The spectrum of reactions range from excitement about the possibilities and potential that is born out of new technology, to mistrust and disapproval of the increasing prominence of digital technology within theatre.

The views that incorporate mistrust or a critical opinion of digital technology in theatre are concerned about the disappearance of the human element and the "liveness" in theatre. Carson (1999) suggests that "any move toward reducing the spontaneity of what takes place on stage and creating a more rigid experience seriously threatens the integrity, also the point, of the live theatre experience" (p.131). Conventions that move theatre away from live performance and

toward a packaged product are considered a threat to creativity and personal connection within theatre (Carson, 1999). Theatre that is overly automated removes the human component; the live and unpredictable nature of performance is stripped away and replaced by mechanical precision and spectacle (Carson, 1999). Court (2007) states that theatre practitioners, "see the arts as a necessary contrast and antidote to the dehumanizing effects of technology in an industrial society" (p. 41). There is concern about the dehumanizing effect already occurring, "legitimate theatre embraced computer technology without thinking about what it might do to stage production" (Grier, 2008, p.7). Technology has allowed the theatre to operate with fewer people which has created a more static and less live environment. There are differing opinions about the role of digital technology in theatre, but having constructive dialogue about its function within theatre is important. "The challenge of introducing any new technology into an art form is to master the technology to such an extent that it becomes an artistic tool rather than an intrusive technological artifact" (Court, 2007, p. 42).

On the other side of the argument there are sources that encouraged digital technology in order to increase the creative potential of the art. Schechner (2000) states that on a "popular level people are not concerned with 'purity' but the availability of diverse possibilities" (p.5). Canadian theatre artist Robert Lepage explains, "The theatre is implicitly linked to technology…There is a poetry in technology, but we try to use it in a way that does not eclipse the action on stage" (as cited in Dixon, 2007, p.360). The uses of technology in modern theatre are twofold; it is either included as it emerges from the process of creation of the production or is directly required within the text of a written piece. When technology is incorporated into a theatrical piece (that is not directly called for within the script), it must address the question of message, in order to appease those who disagree with digital technology. In describing how the marriage between

technology and art can happen, Carson (1999) states that as long as technology remains a tool "used to enhance, to facilitate, to increase and to extend, then the computer will be a vital tool in theatre" (p. 134). As I move into a discussion of the technological innovations being implemented and developed for theatrical productions, I conclude that the debates over the function and role of digital technology come down to a question of how it is being used. Dixon presents a great closing thought regarding use in discussing Lepage's work, "He never used these technologies purely for their avant-garde effect, refusing to play on their capacity to fascinate, but rather concentrate on their function as a tool of artistic expression" (Dixon, 2007, p.360).

2.2 Scenic

Scenic elements create the world that audience members are transported to within a production. These elements cover a wide spectrum of complexity, ranging from a simple black box or an elaborate moving wall. The three areas that I discovered that are experiencing the biggest changes due to digital innovation are in automation, interactivity, and design.

Automation in Stage Machinery

Moving scenery and lights have incorporated components of computer technology for many years. Turntables operated by winches, rigging systems operated by pulley systems, and hydraulic lifts are a few of the technologies that have assisted designers and crew members to create theatre magic for decades. Stage machinery is generally custom-built, and use control systems that are standard to the company that constructed it, however standards are not widespread in the industry (Huntington, 2007). Rigging systems, first developed in the early nineteen hundreds to mimic sailing technology, have now become a mixture of computer and manual control (Young & Minetor, 2010). Modern digital technology applications have begun to reduce the human element of theatre control, to move in favor of automation.

Automation technology increases the range of possibilities in scenic and lighting elements, particularly in regards to the quickness and smoothness of the movement; however, due to the nature of live performance, a human operator is still required: "While the automated action equipment is very predictable, the guy at the control desk needs to have dynamic control to fit in with the actors, who are not always predictable" (Richards, 2008, p.39). The motivation behind the use of automated technologies is typically the 'wow' factor, or spectacle. For example in the recent production of *Chitty Chitty Bang Bang* a full size car flies over the audience, using new automated scenic technologies (Richards, 2008). Modern technology applications have begun to reduce the human element of theatre control, and move in favor of automated technologies. Yet, while innovations in electronically moved scenery have improved efficiency and accuracy, knowledgeable technicians to monitor safety protocols are still required. As Huntington (2007) explains, "Humans should always be in the control loop of any entertainment effect or system that could hurt someone" (p.286).

Interactivity

Interactive digital technology and virtual reality are relatively new categories in digital theatre technology and include a variety of applications. These digital tools are typically used onstage and controlled by the actor. Interactive technologies attempt to create meaning and advance the story line within the production, rather than to simply be used for spectacle. In his article exploring the functions and meaning of new technologies in theater, David Saltz (2001) outlines his definition of interactive media to include, "sounds and images stored, and in many cases created, on a computer, which the computer produces in response to a live performer's actions" (p.107). In a panel on interactive technology at the USITT conference, sensor-based technology was described as "information transmitted from the performer to equipment that is

responsive to the performer's action" (Thurston, 2011). These sensors can be placed within the space or on the performer. Examples of "interactive" technologies include real-time motion capture, virtual reality and sensory technology that respond to movement, proximity, and touch.

Saltz describes the "spontaneous give and take between performers and spectator," as central to the theatre experience; the addition of interactive technology contributes to this relationship (2001, p.109). The virtual reality technology, "invites the audience, viewer, user to participate in or interact with art work that involves being able to navigate freely within a three dimensional environment created by computer software" (deLahunta, 2002, p. 105). The intent of interactive technologies is to create an onstage relationship between the performer and the technology. Wechsler (2006) hypothesizes that interactive stage technology is the future of live performance, "Today in the early twenty-first century, audiences are tiring of digital effects and the interactive performing art scene is in somewhat of a crisis as it struggles to define and develop artistic applications and rationales for the use of technology in general" (p.61). Changes to industry standards and creative processes take time, and interactive technologies aren't yet widely spread in regional theatre.

Design Software

Digital technology is impacting the action on stage as well as the process of design. Software like AutoCAD, Vector Works, Sketch Up and more have made computer generated modeling attainable at a variety of levels (O'Neill, 2005). O'Neill (2005) asserts that, "Technology has turned it favors to the artistic end of the spectrum, and it's not only saving time and money" (p.32). The benefits of digital innovations in drafting software and 3D modeling include: the technology being affordable, more effective and easy collaboration between designers, and gives designers for room and time for creative exploration (O'Neill, 2005). The

result of all these benefits is a change in the way the theatre-making process is conducted. Digital 3D models of sets can be easily changed to supply the director with lots of possibilities and requires less time than in hand drafting. The ability to model in 3D can allow more work to be done before tech, even result in a partially virtual tech with moving scenery and lighting simulations (O'Neill, 2006). Designs can be developed and shared with minimal effort. The time-saving benefits are not the only appeal to designs; by using digital drafting technology can "extend the time that you have to explore artistic ideas" (O'Neill, 2005, p.33). O'Neill (2006) admits that there is a learning curve with digital drafting, but he feels that, "It is a tool that can turn long grueling hours spent in the studio into hours spent agonizing over the right artistic choice instead of how to get it all done" (p.25).

2.3 Lighting

Strong (2010) affirms that, "Production lighting is in a constant state of evolution and is becoming increasingly sophisticated with the development of new light sources, controls and mechanisms" (p.34). Lighting instruments, lighting consoles, and dimmer power control systems are the main elements of a lighting system, all of which can present a complicated technical picture for innovation. In most venues, when an element becomes severally outdated, it is replaced but it is rare that all elements are renovated at once. Strong (2010) suggests that, "a rewire might be expected every 25 to 30 years, while a lighting console is likely to have a useful lifespan of 7 to 10 years" (p.119). While replacing one element at a time is more economically feasible, administrators want to ensure that by adding individual pieces they aren't creating a "web" of technology that could be potential dangerous or even more costly to fix (Wallach & Fling, 2005). The following sections discuss the new trends and products in design, fixtures or instruments, and control systems.

Design

As discussed in the scenic section, recent developments in virtual reality simulations have aided theatrical designers in creating more effective models of sets. Eddy (2011) explains, "With the wider availability of personal computer, designers started to take advantage of computer aided design to speed up the process" (p.43). Once the set has been created in the virtual simulation, the lighting designer can use new digital technologies to plan and design lighting cues in a more realistic manner (Popovich, 2008). Using virtual reality simulations is an extremely useful tool in the planning and development portions of design. Previously, designers and directors were only able to visualize the set within the given space after it had been constructed and installed; now designs can be viewed virtually before construction. Pre-visualization software provides lighting designers an environment to adjust their designs before ever reaching the stage.

Fixtures

Automated or moving lightings have been a part of the theatrical process since the early 1980's, and quickly became an industry standard that increased design capability (Cadena, 2010). Eddy (2011) describes that with this technology, "one light could do the work of many via pan and tilt motors to move the light dichotic color filters to produce color, metal and glass patterns, along with lenses, frost, shutters or irises" (p.41). The developments of automated lights pushed for technological innovations in consoles (to be capable of controlling automated lights) and in turn created the position of programmer (Eddy, 2011). While the position of programmer is now prominent this demonstrates how new technology can create new roles. In 1998, technological advancements in lighting began to advance automated lights in the direction of "digital luminaries", which "enabled a massive expansion of expressive freedom in lighting and

set design, and helped overcome the limitations of 'conventional' automated luminaries" (Cadena, 2010, p.3). Instruments have become smaller, less expensive and have more creative possibilities in digital control of color, position, and intensity. LED's or Light Emitting Diodes over the past ten years have become "brighter and brighter to the point they can finally be a useful lighting tool in our market" (Eddy, 2011, p.43). By using LED and other various new lighting instruments, "even the smallest productions can easily and quickly create colorful animated sets using low or high resolution video content" (Cadena, 2010, p.4). Automated lights have started to taken a secondary role to new digital technologies but still serve an important role to most modern productions (Cadena, 2010).

Control Systems

DMX 512 is the system of digital data transmission between controllers and lighting equipment and accessories. USITT has established DMX 512 as the industry standard in order to "to provide for interoperability at both communication and mechanical levels with controllers made by different manufacturers" (United States Institute for Theatre Technology, 2010b). The lighting industry has very structured standards but there is still innovation happening in control systems. An issue that has often plagued the light design process is mobility in control systems. Designers have been stuck at the light board, or have to take notes during the rehearsal and make changes to the programming at later times. There are two systems that are increasing the mobility and freedom of designers; Remote Device Management systems (RDM) and Architecture for Control Networks (ACN). These are control systems were created to fulfill the requirements of the new instruments that are being used (Halliday, 2010). RDM systems can work with current IPad or mobile device applications to help designers have more freedom and improve the efficiency of the design process. These systems are operated through Ethernet connections, cable

and network components (ELC Lighting, 2011). As Halliday (2010) describes, “once the technology is there, waiting to save you a trip up the truss or keep a critical cue from being messed up in front of an audience, that’s all you will be thinking about the next time you have to deal with things the old fashioned way” (p.107). Implications of wireless technology in lighting could change the industry.

2.4 Projection

Artists began integrating video and projection elements into theatre as early as the 1960’s. As discussed in the theory section, some theatre artists have reservations about adding mediated content into live performance. Regardless of this debate, projection is being used more frequently within today’s productions. Napoleon (2011) describes the inherent benefits of projection, “Projection is a very efficient way of doing theatre, a drop would take three scenic painters 12 hours each, and then the drop is just there. It takes one person between eight and thirty hours to do one piece of animated content. It’s a better use of time and money” (p.37). The literature surrounding projection focused on the emergence of its role in production design and the specific equipment being used to make it possible.

A New Element to Design

Projection is starting to have a more prevalent and consistent role within theatrical production. According to *American Theatre Magazine,* in fall 2010 the highly esteemed Yale School of Drama launched the first U.S. graduate degree in projection design (January 2010). Audience members typically are not cognizant of the prevalent use of projections within modern theatre. In 2007 nearly, “two thirds of the shows on Broadway have dedicated projection designers” (Luber, p.16). The addition of projection designers illustrates the fact that projection has become an integral part of typical theatrical productions, as important as lighting or sound.

Projection and video technology appears to be a bridge or gateway to exploring interactive technologies. The technology has grown with the use of projections in theatre, creating new and exciting possibilities for use.

In an example outlined by Saltz, the use of digital technology is explored in the creation of Ariel for a production of the *Tempest*, which experimented with representing an ethereal character by incorporating digital technologies (Saltz, 2001). He used sensory technology with a live actor, to create a live computer animation of Ariel that was projected onto a screen above the actress. As the actress moved with the sensors attached, her animated character mimicked her movement and responded not only to her movement but to her vocal inflections as well. The other actors onstage interact only with the projection of her animated character, even though she is on stage the entire time. In response to individuals who believe technology is a distraction, Saltz claims, that by using digital technology in this manner, interactive technology is inherently live and ads to the "liveness" of a theatrical piece.

Equipment and Control Systems

New tools in projection include, "show control systems, 3-D stereoscopic display, infrared sensors, and animation software" (Malone, 2009, p.44). The systems being developed to control media and projects are called media servers. Morky (2003) explains that with media servers, "video (or media) content can be programmed with repeatable, editable timing, along with the lighting cues all from a single control point" (p.62). The control of the many components of media (projections or video) required many different systems to operate. Control systems whether they be complex media servers or software, allows the control to be centralized to one main control center (B. Bonniol & C. Bonniol, 2004).

During the USITT Conference many university technical directors were in attendance at projection panels, searching for the best ways to develop and invest in projection equipment. In addition to a control system, needed projection equipment was identified as projectors, cables, screens (Smith, 2011). Major innovations in projection technology and design have influenced how it is being used. Projection usages vary from static images, moving scenery, light effects, real time feeds and much more. Describing the function of the projections used within his production Parboosingh (2009) says, “In theatrical terms, I was interested in using video as an integrated part of the storytelling, not simply a design technique (p.60). In describing use of projection at the La Jolla Playhouse, a technical staff member stated, “For a long time we have known that video was a resource to enhance scenery and create mood, movement, location and iconic imagery, but only of late do we have access to the tools that do just that” (Napoleon, 2008, p.47).

2.5 Training & Facilities

Garonna and Triacca (1999) propose that “social change catches us unprepared and confused” (p.49). The current speed of innovation creates a fear of falling behind, or being behind the curve. Adopting a proactive response to technology by critically examining its impacts can provide a sustainable framework when approaching decisions surrounding technology. In this section I explore how innovation digital technology is changing training and impacting facilities.

Training

Digital production technologies require a completely different skill set to design and operate, than traditional or legacy methods. Kuksa (2009) explains that technology “greatly influences the development of new media theatre, specially contributing to its design and

implementation" (p.73). As new technologies are being integrated into theatre, the different divisions of technical theatre are changing, as well as the way that professionals in the industry are trained. Malone (2009) describes that, "not only are there budding artists wishing to enter the field of new media and learn its attendant theory and tech, but there are others studying theatre that can benefit from considering the field as well…" (p.44). It is not only the new or up and coming theatre artists that are capable of integrating digital technologies into their work. Computer drafting skills that I have described in previous sections have begun to dominate the field over previous hand drafting methods (Kenyon, 2010). Some professionals feel that CAD design is shortchanging the art behind design and "students are happy to let the computer do the heavy lifting and they don't think about layout anymore" (Kenyon, 2010, p.44). It is the loss of these subtleties in digital design that make professionals with classical training slightly resistant to new technologies. Kenyon (2010) strongly feels that, "What is crucial is to divine what is important about how did things in the past and work to incorporate those lessons in our plan for teaching with today's technology" (p.45). In training future theatre artists it is important to create a balance between the art of how things were done in the past, with the efficiency and potential of new technology.

Facilities

The developments in new production technologies within theatre have created new expectations and requirements of facilities. Soloski (2010) outlines modern performance needs by stating, "Today almost no theatrical work—even "poor theatre"—occurs without some sort of technological enrichment or alteration—a spotlight, say, or a microphone" (p.38). No matter the size or configuration of the auditorium, the performances, "are supported by a considerable array of technology in the form of lighting, scenery handling equipment, and sound systems (and

acoustics), all of which need to be integrated with the architecture of the auditorium" (Strong, 2010, p.26). Birringer (2008) further explains that, "information and communication technologies have begun to profoundly transform the role of design" (p.170). When making decisions about creating or adapting a theatrical venue it is important not to be seduced by technology. "Theaters are built with long life spans and technology that is unforeseen when the building is being planned will inevitably arrive" (Strong, 2010, p.63). Shakespeare said it best, *we know what we are, but we know not what we may be* (Hamlet Act 4 Scene 5). What the future brings cannot be predicted but with an eye on future possibilities, a facility with a degree of adaptability can provide an advantageous balance. Having the right space to work in can be more important than the amount of technology that fills the space (Strong, 2010). Arts leaders need to take an active role in determining the appropriate technology needs for their venues.

Some theatres have begun to be constructed with digital technology in mind or have been retrofitted to have certain capabilities. As projection use in performing arts is a recent addition, performing spaces have not always been designed to support this new element of design. In describing a production using projections at the Avon Theatre in Ontario, Rickerd (2001) says, "due to the construction of the venue, the projector had to be placed off-axis to the screen" (p.16). Designers must adapt the technology to fit the space, which can be difficult as projections require specific distances and angles. The best location in the house for a projector is on the center line, in an acoustically isolated control room, that is not obstructed by other hanging instruments. Rear projection is the ideal position to allow an image to span the width of the proscenium. Rear projection does require architectural features allocating significant stage depth (a proscenium opening of 10m requires 8m stage depth), to allow action to take place in front of the back projection screen (Strong, 2010). Boston's Paramount Center's black box

theatre was recently renovated to be a "high tech space" (Lampert-Greaux, 2010). Lampert-Greaux describes several adaptive or transformative features; for example, a large buffer zone backstage that can be used as a space large enough for a rear projection bay. In the past, space for projection was created just as an afterthought, but as projection design becomes an integrated part of theatre, the performance space needs to be adjusted to incorporate this technology.

Wireless coverage, optical cabling, and Bluetooth routers have become standard operating systems in public spaces, not only for the operation of production technologies but also for patrons as they increasingly have more technology that is brought with them (Strong, 2010). Wireless coverage is particularly important when the organization has developed smart phone applications for patrons to use. The New Jersey Center for the Performing Arts, along with other centers, have developed apps that supply patrons with "event listings, ticket selling, audio recordings (streaming, download, public or private), video (live or on-demand), news, blogs, and photos; and have all of their content published in real time to the Partner's own website, mobile apps, Facebook or Twitter Accounts" (Instant Encore, 2011). In addition, front of house systems, like box office stations can require wireless systems as well. LCD screens, HD displays, and touch screens are all being implemented in front of house areas to connect patrons to more information or live feeds of action happening on stage. Arts leaders need to examine the potential benefits of incorporating these interactive technologies into the front of house experience to increase engagement with the public. After exploring a variety of sources discussing theories about technology in art, the new products available in theatrical production, and the result impacts, I wanted to see how this information was reflected in the actions of regional theatres throughout the country.

Chapter Three | Presentation of Data

3.1 Survey Results

Through a survey of regional theatres I was able to retrieve data on how theatres are integrating digital technology directly from the source. This survey was designed to collect data from a variety of regional theatres throughout the United States, in order to uncover national trends in approaches toward integrating digital technology within theatrical productions. I asked questions indentifying the products being use, the training provided, the facilities they work in and how digital technology is a part of their organizational process (see Appendix D). One hundred theatres that fit my criteria of being either a member of LORT or TCG or both, were contacted for participation in the survey. Thirteen regional theatres completed the survey over a five week period (from February to March of 2011). Although the number of responses was lower than anticipated, the responses collected provide a vibrant and instructive sample, containing a variety of data to compare and analyze. The participants spanned different regions, different theatrical concentrations and different production budget sizes. The money budgeted for productions in these organizations ranged from 10,000 dollars per show to 1,000,000 dollars per show which illustrates a varied amount of resources for technology.

The survey was emailed to top artistic staff members (typically the artistic director), or production staff members (either the technical director or production manager) and in most cases it was sent to both. This generated a range of responses reflecting the artistic view of digital progress in theater in comparison to the experience of the production staff to document any diverging opinions. The responses received in this sample were predominately from production staff members (10 production managers, 2 technical directors) with only one artistic director responding. The high percentage of responses from production managers indicates that, as digital

technologies are being integrated into productions, it is the production managers who oversee, implement, and manage the organizational approach toward digital technology. In response to my call for participants, several artistic directors indicated that they had no knowledge regarding what digital technologies were being implemented within their theaters. A production begins with an artistic vision and then through theatrical craft and ingenuity that vision is given form and life through a palette of production technologies. It stands to reason if members of the artistic staff are unaware of the new possibilities created by digital technologies it can limit the potential of their productions.

Products and Trends

One of my sub questions for this research is: what are the new digital technologies (products and trends) being developed and implemented in regional theatre? I used this survey to identify what products are currently preferred and to uncover the reasons behind the preference. The overall trend in the products being used that emerged through the survey were that they must be adaptable for many uses. Buying a piece of large expensive equipment to fulfill one-time needs is not a stable technology decision-making approach.

Scenic

For the thirteen regional theatres that replied, the latest additions in digital scenic technology that were most typical were automation control (software), pneumatic automation, and CNC routers. CNC is the abbreviation for Computer Numerical Control and refers to a wood router that is controlled by a computer to create designs (Albert, 2011). Computer operated tools are typically used to create complex patterns in a faster time frame. Many regional theaters have implemented a combination of computer controlled automation and simple mechanical systems. The survey results indicate that when resources are available, theatres are moving towards using

more computer controlled equipment that can increase the efficiency and accuracy of moving scenery. Four theatres within the survey use an automation system in their productions operate Creative Conners automation systems. The popularity of the Creative Conners system is due to consistency, cost, and flexibility. As the website states the Creative Conners systems are, "reliable and affordable for theatres and scene shops of all sizes. We offer a line of products that make scenic automation possible for everyone. Our modular approach to motion control makes it easy to buy exactly what you need." (Creative Conners, 2011, para. 1). Other theatres surveyed either did not employ automation in their productions, or had created in house systems. Moving scenery systems are comprised of a wide spectrum, including simple motors and winches to highly digitized computer controlled systems. The data collected in this survey suggests that advancement and integration in scenic digital technology is directly dependent on the size of the organization, cost of the equipment, and the production needs. Decisions regarding product purchases are driven by the needs of the individual productions. One respondent explained, "We have a Creative Conners system, but use it sparingly - perhaps one production per year" (personal communication, March 2011). When organizations have the resources to innovate their digital technology for scenic elements, the current movement is toward enhancing the computer operated automation systems.

Lighting

In lighting design, the main purchases in digital technology include lighting consoles and lighting instruments. Although a few theatres expressed interest in increasing the number of dimmers available, none of the participating theatres specified that they were replacing or renovating their dimmer systems. The respondents primarily operate four varieties of consoles: ETC Express and ETC Expression (both created before 2007), and ETC EOS and ETC ION

(created after 2007) (Electronic Theatre Controls, 2011). The latest version of the ETC EOS console was selected as the *Live Design's* Lighting Product of the Year in 2010 (Sandberg, 2011). In the production description it states that, "The EOS lighting console provides simple, approachable control in a nuanced programming environment, with unmatched power and depth" (Electronic Theatre Controls, 2011). One theatre reflected the popularity of the EOS console: "As mentioned we have an ETC Eos in our second stage, our main stage and studio spaces use Obsession II's, but we plan to upgrade the main stage to an Eos in the next few years"(personal communication, March 2011). The majority of the sample theatres were operating consoles created before 2007. This data indicates that the technology in console design that is over five years old works adequately to support production needs, even though new systems have been produced. The data collected describing recently purchased digital technology in lighting instruments had a trend toward LED's products, with 40 percent of respondents saying that their next investment would be in LED lighting equipment. Increases in theatre companies investing in LED instruments authenticates that the technology is reaching a point in which consumers feel confident in the quality and worth of this relatively new product.

Projection

The final production area that was surveyed included innovations in projection equipment. Two theatres indicated that they had recently invested in projection equipment, specifically in high definition projectors. Another theatre stated that the digital technology that they would invest in next would be projectors. None of the sample theatres expressed an interest in the equipment used to run or operate the projection content. The survey attempted to establish a trend in the use of projection but the data collected was wide spread; projection is still finding its place within theatrical production design. On the extreme end of the spectrum, there were two

theatres that used projections in all or most of their productions and there were two theatres that did not use projection at all. The remaining participants represented a wide range within the number of projections used from one or two shows per season to over 50 percent of the season.

Integration

Innovations in digital production technology can be costly; renting equipment can provide an outlet for regional theatres to experiment with new technology without fully investing in new potentially expensive equipment. Exploring the trends in buying or renting equipment, within this sample, produced mixed results, and revealed no consistent approach. The decision process driving an organization to rent or buy new equipment is dependent upon the production, item needed, and the overall budget of the theatre. In this survey, the rental budgets for productions ranged from zero to 15,000 dollars. One participant effectively summarized the underlying trend in this area, "on average we rent and buy based on cost effectiveness and in-house demand" (personal communication, March 2011). It was common for the respondents to have legacy equipment that worked with the new systems of technology. This priority was explained, "Like most theatres, we are continually adding to our inventory and occasionally we have issues with communication between older and newer equipment, however we make a point of doing a great deal of research prior to incorporating new equipment into our current inventory to avoid these problems" (personal communication, March 2011).

In trying to establish common themes in technology trends I asked the survey participants if any departments had preference when spending on innovation. Over half of the theaters said that no department has a preference in innovation and expansions in technology. Only one company indicated that they tended to give video preference explaining that they frequently implement video as a scenic element. Another theatre explained, "It tends to rotate, although

lighting and audio are the departments that require the most frequent upgrading due to technological obsolescence" (personal communication, March, 2011). Regional theatres aim for departments to slowly integrate technology, creating a balance so that one department doesn't outshine the rest. Even though balancing investments in technology between departments is ideal, technology in certain areas develops at a faster pace, which creates differing levels of technological innovation. My final question for the participants was to rate the importance of new digital technology to their organizations. On a scale from one to five (with five being very important), results again were varied, but the greatest percentage of respondents (38.5%) rate the importance of digital technology rather low- rating it at a two. The next highest percentage (30.8%) rated technology rather high- rating it a four (comprehensive results are detailed Figure 2).

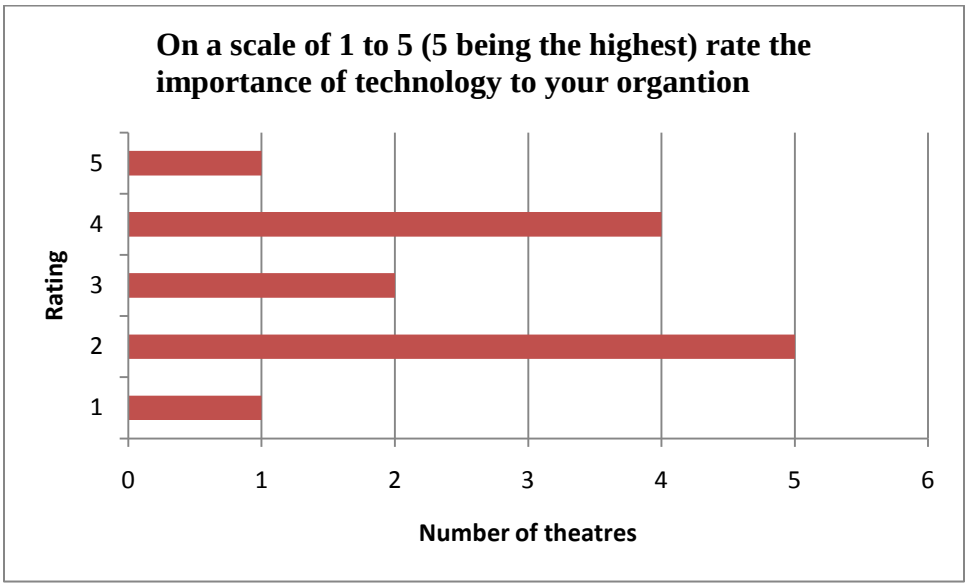

Figure 2 Importance of Technology

There is no right answer when it comes to incorporating digital technology, but it is an important question to ask. It seems that this divide between theatres either believing that digital technology is relatively unimportant, to theatres feeling that is very important is indicative of the

dynamic times that were are currently a part of. The variety of attitudes expressed in this survey regarding the importance of technology illustrates a dichotomy between those that feel that digital technology is the future of theatre and those that believe that incorporating too much technology threatens this live art form. The methods and strategies of the theatrical process are shifting; identifying what is important as an organizational approach to new technology is critical to the future.

Training

Questions regarding training also revealed a variety of responses. The survey explored if training was provided for employees on new technology and if staff members attend appropriate conferences and trade shows. With tight schedules and even tighter budgets professional development and exploration can take a back seat to the day to day priorities. The majority of theatres in this sample provide training for staff on new equipment, as it is typically a necessity that crew members, programmers, and board operators are familiar with the equipment. This may indicate that technicians and designers who have a thorough knowledge of a variety of systems are attractive potential employees.

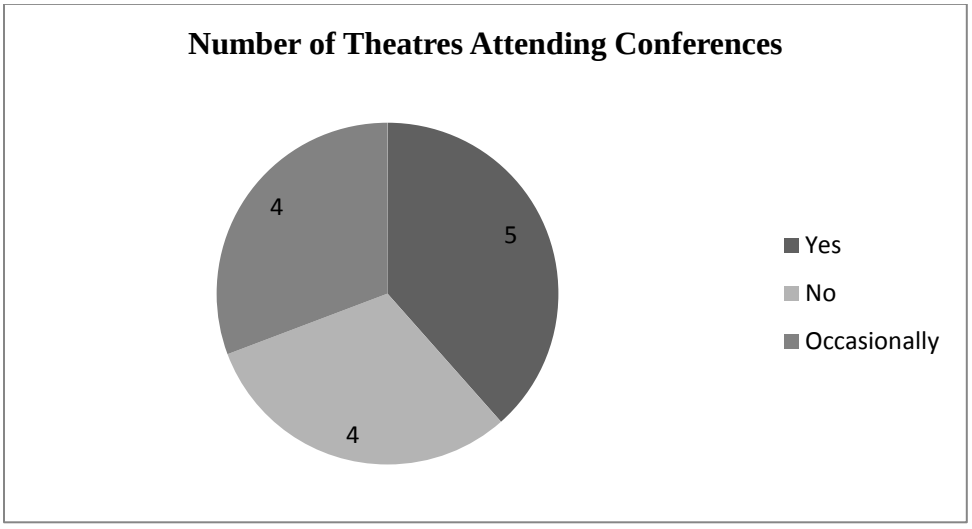

Figure 3 Organization Conference Participation

Attendance at trade conferences within this group was pretty evenly split, as demonstrated by Figure 3, a third that regularly attend, a third that attend when the budget allows, and a third saying that they don't attend production technology conferences. Conference and trade show participation emerges from the need to understand or adapt to new technology as organization require new systems. It appears to be uncommon for professionals to be learning about new equipment with a correlating need. Discussing and developing approaches to new technologies at professional gatherings is an endeavor that isn't actively pursued by the majority of organizations.

Facilities

This survey contained a collection of theatres that were constructed from 1965 to 2005 (with one theatre that was built in 1760, which was renovated in 1994). Half of the group had theatre spaces that were built in the 1960's and 1970's, providing evidence that the 1960's represented a great dispersion and creation of regional theatres in the United States. The other half of the sample had theatres built in the 1990's and 2000's. New technology makes new demands on the buildings that house them, and I wanted to discover if any of the organizations had altered or renovated their spaces for technological purposes. The results were almost exactly divided down the middle. Retrofitting for audio and lighting, renovations to power distribution, and the addition of Ethernet, represent the type of projects that organizations had accomplished. New technologies are being developed to be adaptable for the space that they operate in. It is a simpler process to adjust technology than it is to change the building that supports it. It also supports the fact the theatre professionals are creative and resourceful within the available space that they are provided.

Overall the data collected in the survey mostly confirmed and supported the information about products and trends discussed in the review of literature. Although in the day to day reality of theatre making what can be implemented and afforded impacts technological progression. Some of the theatres were operating simpler and less expensive versions of the equipment that was highlighted in the review of literature. The biggest revelation that the survey material uncovered was in the approach to implementing technologies. Being on the cutting edge of technology wasn't of particular importance to the organizations; the driving force behind innovation came directly from the specific needs of productions and the available resources of the theatre.

3.2 Denver Center Theatre Company – Case Study

Selection of Site

To triangulate the data collected by the survey and review of literature, this research also entailed a supplementary in-depth study of how one organization (focusing on their distinct outlook and methods) is integrating digital production technology. By examining their unique approach to incorporating emerging technology; their successes, failures, and impacts, a clearer picture emerges of how regional theatres are integrating digital technology. For the purpose of this research an ideal case site demonstrates an active relationship and current dialogue surrounding innovative methods of integrating digital technology into live performances. After exploring potential sites, I selected the Denver Center Theatre Company (DCTC) due to their work with EMC Arts, in addition to the fact that they are one of the few regional theatres in the country that have created a full time multimedia specialist staff position (Moore, 2010).

EMC Arts is a nonprofit organization that "encourages and supports innovation in the arts sector" (EMC Arts, 2011a). EMC Arts has several service components, one being the Innovation Lab which " helps arts organizations challenge core operating assumptions, engage in intense planning on practical innovation projects, create a sense of organization-wide investment in change, and test innovative strategies with grants that help organizations prototype new practices" (EMC Arts, 2011b, para. 3). In 2010, the DCTC was selected to receive a grant and support services from the Innovation Lab that enabled them to develop new programming using technology in new ways to engage an emerging generation of theatre goers (Moore, 2010). For this case study, I researched the Denver Center Theatre Company's background and history, reviewed articles about the current organizational programming, and conducted interviews with department heads, and artistic and production staff members to map ideas and approaches to

digital technology integration. Interviews were conducted with Artistic Director Kent Thompson, Resident Multimedia Specialist Charlie Miller, Assistant Tech Director Josh Prues, and Director of Lighting Charles MacLeod.

Organization Description

The Denver Center Theatre Company is a premier nonprofit regional theatre company which raised its curtain in 1979 (Denver Center, 2011). It is a Tony Award-winning (1998) professional regional theatre, with a current operating budget of approximately 12 million dollars. They produce classic plays, contemporary new work, revivals and recently have focused on producing world premieres (Denver Center, 2011). The DCTC is part of four (albeit soon to be three) components that comprise the Denver Center for the Performing Arts. The other components include Denver Center Attractions (the Broadway presenting organization), The National Theatre Conservatory (a nationally acclaimed Master of Fine Art program which is closing in 2012), and The Denver Center Theatre Academy (a theatre education program for schools and individuals) (Denver Center, 2011). The mission of the Denver Center for Performing Arts is:

> As the flagship theatre of the Rocky Mountain region, The Denver Center for the Performing Arts creates and presents exceptional theatre that engages, excites, provokes and inspires both artists and audiences. We embrace the classics while also striving to create new plays and musicals that advance the American theatre. We are committed to making The Denver Center a center for lifelong learning and civic engagement (Denver Center, 2011).

The DCTC has four spaces in which they perform: the Stage (thrust stage with 700 seats), the Space (arena stage with 550), the Ricketson (proscenium stage with 250 seats), and the Jones (proscenium stage) (Denver Center, 2011). In a typical season, which extends September through May, they produce eight to ten shows. Throughout their thirty-two year history the DCTC has been lead by the vision of three Artistic Directors: Kent Thompson (2006 to current), Donovan

Marley (1984 to 2005), and Edward Payson Call (1979 to 1983) (Denver Center, 2011). Under the leadership of Kent Thompson for the past six years, a strengthened organizational vision and focus has emerged. This vision promotes and encourages new work through the Colorado New Play Summit, and aims to explore the relationship between live performance and digital technologies.

Only in its sixth season, the Colorado New Play Summit has already drawn national attention establishing the summit as, "one of the most important new play events in America" (Moore, 2008). Rutgers University playwriting professor, Jason Grote stated, "There are plenty of regional theatres that have lots of money, and there are small theatres everywhere that take risks. You usually don't get to see the combination together" (Moore, 2008). A focus on fostering new work and future generations of playwrights is not the only way that the DCTC is committed to carving out a unique place in modern theatre in America. In an effort to increase audience participation, the organization has advanced experimentation and exploration in new uses of technology within productions, adopting a groundbreaking approach to technology, which was made achievable by a grant from EMC Arts. They are embodying an "organization-wide investment in change", as dictated by EMC Arts, by infusing a proactive and positive approach to digital technology in all areas of their work.

The DCTC has announced that in the 2011-2012 season they will offer alternative multimedia programming to be produced in the Jones Theatre (Moore, 2011). This programming will be interdisciplinary, aim to both "compliment and contradict" the regular season, explore the relationship with the audience and address how using new technology can enhance the experience (internal doc, 2010). This series, titled "Off-Center", intends to attract new audiences while providing the ideal space to play with emerging technologies in a comfortable performance

atmosphere. Their goal is to increase appreciation for theatre in new generations through innovative and relatable theatrical experiences. As Baskhi & Throsby (2009) explain, "New technologies have provided opportunities for cultural institutions to re-think the ways in which they pursue their principal objectives" (p.15). This innovative approach to programming has the potential to redefine the experience of theatre for 21st century audiences.

A New Approach – Interview with Kent Thompson

I was impressed by the innovative and thoughtful ways the DCTC is incorporating digital technology and attempting to bridging the dichotomy of opinions on its use. I interviewed Artistic Director Kent Thompson with the objective of having their technological framework or digital identity and approach explained by the individual who helped create it. Thompson provided an illustration of what motivated the DCTC to pursue exploration and experimentation within digital technologies:

> A few years back we produced a show where the playwright had written in a lot of projections, and we didn't really have the capability to project very well, and I think that is when I realized (it was my first or second season) that we have to upgrade and support the technology if we are going to do this, otherwise it is not a satisfactory experience for everyone, the artist, the actors and the audience (personal communication, March 28, 2011).

In discussing digital technology, such as media and projections, Thompson explained, "We try to use it (projections) as a story telling device or something that is important to the intent of the play…We use it in the same way we would use another technology like lighting, or sound, or music to make sure that it is enhancing the performances rather than overwhelming them" (personal communication, March 28, 2011). It can be a challenge to incorporate multimedia, but the DCTC strives to create a clear rationale behind any use of technology within their productions. As this production-driven approach emerged, the framework and decision making surrounding the inclusion of digital technology has become more institutionalized. Thompson

explained that between himself and the Production Manager, the DCTC has developed a "fairly rigorous approach toward production content development, we will explore if it is called for in the script and if not we ask the designers if they feel that (multimedia) is a needed element for the production" (personal communication, March 28, 2011). Although the DCTC has built up the resources and staff to provide every show with projection design, they analyze each show and determine whether its use will be effective. Thompson felt that audiences today are more open and willing to tolerate video and projections within live performance: "When it is a really remarkable projection design, it can be quite evocative for the audience. The audience today finds it less distracting then they used to" (personal communication, March 28 2011). Thompson is aware of the dichotomy between mediated elements and live performance, explaining:

> I have to say that I think that if we take the technology to far of an extreme we lose our greatest asset, which is the live human being in front of us and acting itself, if we lose that in the rush to technology I think that we haven't succeeded. Sometimes I think that's happened in our productions where we have just had too much, it's like sensory overload (personal communication, March 28, 2011).

Learning from their mistakes and moving forward with new protocols and frameworks is what makes the DCTC a model in digital technology integration. For the next part of my exploration of this organization I examined specifically what new digital technologies were being implemented.

The Technology

In order to get the pulse of what technological trends and advances are being implemented by this uniquely open and experimental organizational approach to technology, I investigated the scenic, lighting and projection departments. Within each department the following themes were explored: the current products and systems being used, emerging trends

and desires for investment in digital technologies, procedures regarding training on new technology, and finally how the facilities they perform in informs how the technology is implemented. It is important to note that the DCTC produces shows in four unique spaces; therefore it is difficult to provide overarching answers to questions regarding technology, as each space has unique challenge and capabilities. (Josh Prues, personal communication, April 8, 2011).

Scenic – Interview with Josh Prues

To uncover the equipment and methods being used by the scenic department, I interviewed Assistant Technical Director, Josh Prues (who is also the head of automation at the DCTC). The scenic department uses digital technology from idea in the creation process to implementation in the action of the performance. The most apparent and frequently used digital technology at the DTCT is their automation systems. For their automation needs they have a custom Creative Conners system that has been in place for three years (personal communication, April 8, 2011). This system allows them to easily move scenic elements through computer control. The top current priorities in automation technology identified by Prues are computer control, wireless compatibility, and safety. Computer controlled automation allows for effective and efficient scene changes and is used in addition to manually operated devices, DCTC aspires to expand the efficiency created by digital technology into the tech rehearsal and development process by implementing wireless controls. Wireless technology will allow the designers to move and adjust scenic cues from the positions in the house and provide more effective tech time use.

A main concern for Prues is safety, regardless of the type of tools, equipment or technology being used. Moving large pieces of scenery can be potentially dangerous to crew,

operators and performers, therefore proper safety controls are critical. Automation systems entail a significant financial investment. The DCTC upgraded their system approximately three years ago, and Prues commented that he felt the current system would remain adequate for a minimum of ten years, or until extremely significant changes in technology occur. He explained that "it is such a huge investment that constantly looking to change your system is a waste of time because you don't have the money to continually upgrade your system. Getting something that works for you and refining it is a better way to go" (personal communication, April 8 2011). As mentioned in the survey results, one element that might deter companies from using advanced automation equipment is the cost. While talking with Artistic Director Kent Thompson, he outlined how their relationship with Denver Center Attractions has helped offset some of these major technological costs. He explained that as the result of a coproduction in a previous season they were able to make great leaps in automation technology because of the shared investment (personal communication, March 28, 2011). Using partnerships and collaboration can be a useful tool for organizations that are looking to make technological innovations with limited resources.

After establishing the technology used within the scenic department I inquired about any changes in policies regarding training for new equipment. Prues explained that some of the more seasoned crew members did require some basic computer training, but as the current system has been in place for several years most staff and crew have reached a satisfactory level of proficiency (personal communication, April 8, 2011). Digital technology has made the art of automation smoother, quicker, and more effective. It is interesting to note that when discussing advances and possibilities presented by wireless control, the DCTC only uses it in a non-show capacity. Using wireless control during tech rehearsal and then returning to wired control for in

show use reflects a concern about the reliability of wireless technology. Prues expressed a focus on the functionality of the equipment being of more important then having the most recent technology. Technology might be able to provide some enhancement, but if the effect can be accomplished using the systems already in place; the demand for new technology is diminished. In the show-driven process that the DCTC has created, innovations technology are tools to be used when needed by the production and not vice versa.

Lighting

Next I discussed new equipment and integration methods in digital lighting technology with the head of lighting, Charles MacLeod. In their three main spaces, the DCTC has ETC Eos consoles that were purchased two years ago, which are fully networked. As stated in previous sections the EOS console has received award for its ease and capabilities and is widely used in the field. MacLeod explained:

> When we were using moving lights on the Light Palette 90 (which at the time was 16 years old), whenever we wanted to make the light move it took 24 consecutive control channels to make it work, so the designer and board operator had a matrix of controls so that they knew exactly what channel they needed to call up. Whereas with the EOS I don't have to think about a number I simply think of an attribute like color, position, gobo…it is so much easier (personal communication, March 22, 2011).

This system cost approximately 150,000 dollars to install. In regards to instruments MacLeod outlined that they had a proportional amount of moving instruments, but haven't delved too deeply into the world of LED's. They use the minimal LED stock that they have for accenting scenic units but not for larger tasks like cyclorama lighting or stage washes. MacLeod explained his hesitancy regarding LED's, "We checked into them a few years ago and discovered it would be about 100,000 to outfit our theatre with LED's. It's only a matter of time until we submit to that market but until it becomes more stable, a little easier to add on down the

line (at this time it is very hard to get an exact color match and color temperature match), we will hold off" (personal communication, March 22, 2011). The majority of the moving lights in their stock are High End moving lights that are convection cooled, making them very quiet. Since all of the spaces at the DCTC are relatively intimate, the quietness of their instruments is a priority. These instruments are around eleven years old and are maintained in good working order because they provide great functionality at low volume levels.

In terms of investment in technology, the DCTC's most recent purchase was three Eos consoles. They tend to buy, rather than rent equipment, taking time to ensure that the purchases they make are right for the organizational as a whole (not just for the individual production). Their legacy and new digital technologies work seamlessly together, although it was revealed that understanding the network wiring and capabilities of the new consoles was challenging. For example, MacLeod explained it was challenging, "trying to get the Ipod and Ipad to control the system and work seamlessly" (personal communication, Charles MacLeod, March 22, 2011). Training is provided to all staff on new equipment. Most the equipment used is relatively standard, so implementing additional training has not be an issue, but when the Eos console was installed none of the local stage hands were familiar with the technology. It was approximated that after a year all staff members were comfortable with what the console was capable of. However, with MacLeod acknowledged, "that we probably only scratch the surface in our productions, it's a pretty powerful board" (personal communication, March 22, 2011). Digital technology in lighting changes fast, the DCTC approaches the adoption and integration of technology as dictated by the needs of the productions, rather than changing technology trends. It is clear through their views on LED's that they have put a system of checks and balance in place to assess if it is the right time to invest in new technology.

Projections

The DCTC has developed an exciting view on the role and use of multimedia and projections within productions and is exploring this avenue in a variety of ways. The DCTC recently created a full time staff position to focus on projection and media needs for the organization. Charlie Miller occupies this position, titled Resident Multimedia Specialist. This position has many different tasks, from projection and media content design, to creating online content for marketing purposes, to the recent addition of programming the Off Center series. Being on staff, Miller is able to work on a variety of projects and needs and not be concerned with show by show employment, as is the way many other designers are employed.

The DCTC produced ten shows this season, with four shows containing projections and another three that had discussed the possibility before concluding projections were ultimately not needed. The DCTC uses Isadora software for content delivery rather than media servers. According to Miller, "Isadora turns your computer into a media server and it is the cheapest content delivery system, I think eventually we will move to a media server, but for now Isadora can do all the functions that we need" (personal communication, April 8, 2011). The Isadora product description states that it is a, "award-winning, graphic programming environment for Macintosh and Windows that provides interactive control over digital media, with special emphasis on the real-time manipulation of digital video" (Isadora, 2011). In explaining their philosophy on purchasing new equipment, Miller said the current focus was on software and computer power: "We recently purchased two Mac Book Pros with Editing Software, Isadora, and extra video cards" (personal communication, April 8, 2011). His rationale is that it is better to invest in computers, software, and even projectors (although expansive) over Media Servers or other content delivery system, as the delivery system has less direct impact on the overall quality

of the projection. Miller identified that the only area in which media servers are significantly superior is in the delivery of live video feeds (due to a lack in delay). As the cost of projection equipment is very high (with projectors that can cost 40,000 dollar) I inquired about ways that they handle the high price of innovation. When purchasing equipment, they consider the financial impact as well as the human resource time (training) that might result. They have worked on leveraging partnerships to supplement the equipment they have available to them. Miller explained, "we have a unique relationship with the ballroom (an event space that is part of the Denver Center of Performing Arts), they have three 10k projectors, so we can borrow those projectors for the length of a run which is much better than renting because rentals over a long period can get so expensive" (personal communication, April 8, 2011). They also have created sponsorship opportunities with local rental companies to receive lower rates.

Miller acknowledged the obstacles presented for projections in all of the DCTC spaces, but concludes that the challenges only make them have more creative solutions and uses of projections. As projection and media design is still a developing area of design in theatre, the DCTC is a clear example of emerging best practices in developing a projection department.

Summary

The Denver Center Theatre Company has worked diligently and responsibly to create a confident and comfortable atmosphere surrounding the use of technology. They have created a new model for addressing the dichotomy of attitudes toward digital technology and liveness in their theatre-making process. As leaders in this type of balanced integration, they actively communicate, measure and address the impact of their technological decisions on shows, designers, performers, directors and the audience. Their organization wide approach toward innovation gives them the ability to create innovative theatre for modern audiences.

Chapter Four | Analysis

In this chapter I will synthesize the information gathered from the review of literature, survey, and case study in order to address my research questions. The purpose of this study is to discuss overarching trends and identify possible solutions in technology implementation. The goal is not to provide absolute answers but to guide individuals and organizations to develop their own unique technology frameworks. To restate, the purpose of this research is to examine digital technology innovations and integration approaches in theatrical productions occurring in regional theatres in the United States. This research identifies and highlights trends and issues facing 21st century theatre. It aims to demonstrate how integration methods and production advancements are incorporating technology to increase efficiencies as well as expand the creative possibilities of the art and process of theatre-making. My research questions include:

Question: How are regional theatres integrating digital production technologies into performances?

Sub-questions include: What are the new digital technologies (products and trends) being developed and implemented in regional theatre?

How are new digital technologies being integrated into facilities?

How are new technologies impacting training for theater professionals (university training as well as professional development)?

How are these innovations impacting theatre as an art form?

4.1 Products and Trends

In order to fully understand how digital technology is impacting the art of theatre-making I first needed to know what products are being used. The review of literature identified the emerging products being used in the areas of scenery, lightning, and projection, while the survey

and case study provided data which illustrated which products are preferred and what trends are spreading across the nation.

Scenic

Currently, the prevailing developments in digital scenic technology include computer controlled automation, design software, and interactive elements. Automation technology and digital software are the two areas that are most applicable for the regional theatres. Broadway and large live concerts are constantly searching for new technology to wow audiences. This investment in innovation triggers a trickledown effect that makes new technology that was previously unattainable for regional theatres more accessible and affordable. As Huntington (2007) remarked, "With its increasing ability of sophisticated, low cost, computerized controls, stage machinery, mechanized special effects, and show action equipment have been become increasingly widespread and increasingly automated" (p.165). Advancements in digital technology have made moving scenery more efficient and precise, and a more financially feasible option for regional theatres. It was surprising that within this study the regional theatres involved had a clear preference for Creative Connors automation systems. It was explained that these systems are both affordable and customizable. The ease at which these systems can be customized to fit the space in addition to their ability to adapt and grow in response to individual show needs is a high priority when making decisions about automation equipment.

The emerging trend that is developing in response to having more digitally controlled automation is a movement towards wireless control. Having the ability to control systems via wireless connections like a lap top, tablet, or phone is the next step in automated control systems. While this feature would have multiple uses during the design and the creation process, it is interesting to note that it is not currently considered a viable option for in show use (Josh Prues,

personal communication, April 8, 2011). When operating in shows, wired systems are more reliable for operating large, moving scenic pieces. This demonstrates safety concerns and supports the prevalent idea that a human must have control when it comes to the operation of potentially dangerous equipment. Innovating scenic technology is very costly, therefore theatres are cautious, and approach investing in systems gradually. Theatres that have the resources or opportunity through partnerships (like the Denver Center Theatre Company), to implement digitally controlled systems have the ability to make scenic transitions safe, smooth, and consistent.

Software used to design sets and lights has gradually become more prevalently used, providing designers new ways of creating, sharing and adjusting their vision. O'Neill (2006) outlined the opportunities be created by digital design tool,

> It's out there now and being put to good use in smaller venues and a few forward-thinking studios…Of course, there is a learning curve to its implementation and a slight investment up front. But the savings in time, money, and sanity makes it a tool well worth exploring and one to help us further our expression, impression, and interaction (p.25).

The review of literature revealed the revolutionary idea of interactive scenic elements which consist of digital elements being controlled by movement of the performer. The USITT conference supported these findings through a panel discussion of developments and use of interactive technology. Although this technology is available and it uses have been demonstrated, I did not find evidence of its use being widespread within regional theatres. Interactive scenic technologies, which have been implemented into dance, might represent the next wave in theatrical design, but for now it is still developing. Through distilling the information uncovered about the products being used in digital scenic technology I found that digital components are infusing traditional methods to increase efficiency and expand creative possibilities.

Lighting

We move from the realm of scenic technology where innovation in technology outpaces the speed of implementation (due to the high cost), to the realm of lighting where quickly shifting technology is implemented in a more consistent pace. Innovation in lighting technology happens at a fast pace, and for the companies that have the resources and ability, it can be implemented just as quickly as it is being developed. Many companies in my survey had lighting consoles that were released in the past 5 years, which indicates the priority placed on investments in lighting equipment. The major trends surrounding innovation in lighting technology involve LED instruments, new consoles, and wireless tools. LED lighting technology has been available since the 1990's, but now the technology has been refined and is more stable and standardized (Eddy, 2011). Previous complaints about flaws or inconsistencies have been addressed and help to make LED's a more realistic option for regional theaters. The progression within lighting consoles has been truly remarkable, creating both more efficient programming and design process, while also increasing the creative possibilities. The process of patching and programming lights traditionally entailed a complicated and time consuming process, especially for moving lights, which due to digital technology has been exponentially simplified. As internationally renowned lighting designer Richard Pilbrow remarked, while speaking on a panel on lighting apps, "My desire is for the technology to help me take what is in my brain and make it into reality in as few steps as possible" (personal communication, March 9, 2011). New technology within lighting consoles has begun to streamline the process of design, making Pilbrow's dream a reality.

Lighting innovation, though still costly, is simpler to integrate and is therefore a more frequent investment for regional theatres. Lighting equipment, whether it be consoles, dimmers,

or instruments, is a highly standardized field and its emerging technology quickly conforms to previously established systems. This indicates that a theatre might have a wide spectrum of lightning technology but it works together in a relatively harmonious fashion. The future of technology in lighting reflects the trend in scenic technology in wireless technology. Wireless technology gives designers and operators freedom from being tied to one spot, which also allows designers to make quick changes to a design. Wireless technology in any area suggests that intricate networking systems must be in place. This research found that this is the area where integration is not as easily done. An intriguing development in lighting technology is a balance between lightning and projections. When describing the ideal product, McLeod outlined an instrument that was made with the power of a typical lighting instrument but the capability to upload images to create digital gobos to project on stage (personal communication, March 22, 2011). As the field of projection is being developed, its uses as a lighting instrument are being explored. This relationship is still being crafted and will be interesting to track over the next five years.

Projections

The final product component that this research explores is projections and media, which are currently the most prominent and developing area in the field. This section focuses on the technology within projections, and will address the emerging field later in the analysis. Projection is an intriguing area of theatrical design, as the technology that is being used in projection is innovative, and the field itself is still being defined. As this is an emerging area of design, there is some debate over its function (is it lighting, or scenic, or something separate?). It hasn't been accepted as an industry-wide design element but is generally implemented on a show by show basis. Video, media, and projections started out as simple additions to theatrical

productions, as either an element directly called for in the script or as a creative storytelling device. The technology has become increasingly advanced and has been used in a variety of creative ways. Two examples of such advances include 3D projections currently being developed for the opera, and 360 degree projections used in a recent production of Peter Pan (Strong, 2010). The focus of emerging technologies in projection appears to be in projection control systems. At the 2011 USITT conference there was a distinct focus on media servers. There were workshops and panels regarding what they were, why they were important, and how to craft your own version of a media sever to fit your needs and budget. While the large, highly complicated, and expensive media servers haven't really made their way into regional theatres, programs like Isadora provide sufficient, and in some cases, superior alternatives. Isadora is a less expensive software system that many regional theatres have adopted in their process of including projections in their productions (Charlie Miller, personal communications, April 8, 2011). While approaches, systems, and technologies are being developed, it is the assertion of this research that the area of projection and digital media integration will continue to be a prominent focus with theatre technology for the foreseeable future. As more regional theatres embrace the creative potential of projections, the institutionalized model that has been established at the Denver Center will be more prevalent across the field.

4.2 Integration with Facilities

Upon beginning this research I assumed that facilities had a large impact on the availability and implementation of technology for regional theatre. I thought I would find that certain emerging technologies were not being implemented in theatres as a result of limitations imposed by their physical space. I discovered that technologies being developed for theatre production are designed to fit the spaces in which they are used. As this study progressed I

discovered that although facilities might present a challenge to the use of certain technologies, those challenges are not a deterrent. For example in my discussion with Charlie Miller, he suggested that none of the spaces at the DCTC were ideal for projections, but this forced them to develop creative solutions (personal communication, April 8, 2011). The main way that facilities are being adjusted to adapt to technology is in networking and wiring capabilities. Although facilities are not being altered to accommodate new technologies to the degree that I originally believed, technology is a consideration when new facilities are being constructed. The recently constructed, New World Center was described as, "A concert hall to reach new audiences for classical symphony; through music—combined with spectacle. Set in an intimate, thrilling space, and wired for the entire world to share" (Pilbrow, 2011, para. 11). Innovations in new facilities are being developed to sustain the technology being used today, the most apparent modifications being made for projections.

4.3 Training Implications

As digital technology is changing the way that we create and experience live productions, it is also changing how organizations are educating staff members on new technologies as well as how these trends are changing university training. This research only touches on this topic, but there are implications for future research. Most organizations have a very reactionary approach to professional development within technology. When the organizations need new equipment, after a good deal of research, they purchase it and then learn how it works. The impact of this cycle is that technology might have unfulfilled potential, until a new need is identified. When new equipment is purchased, staff might only learn the basic functions in order to "get by", but understanding and being able to use the technologies to their full capacity is a gradual process. The "get by" attitude might be attributed to the fast pace of change in technologies; is it worth

the time it takes to master a product if it might get replaced in a year or two? I found that it is less common to have professionals in the field proactively seeking to learn new equipment without a correlating need. This appears to be a function of budget constraints and time limitations. Digital technology is rapidly changing the training received in universities. This is demonstrated in new programs being developed (like the Masters in Projection at Yale School of Drama), and by the new skills that are being required (American Theatre Magazine, 2010). The USITT conference offered an interesting panel discussion over the paradigm shift in the design process between hand drafting to digitally created designs. All of the panelists stated that they expect anyone that they hire to be proficient in both methods (Franklin-White, 2011). There was a feeling between the panelists that designers' portfolios were becoming too prominently digitally focused. As represented by many of the ideas within this research having a balance of digital and legacy skill sets is the current development in training and education. Digital innovations haven't phased out traditional ways of creating theatre but a combination of skill sets is required to make a multidimensional creative team member.

4.4 Making 21st Century Theatre

After compiling and analyzing material on innovations in digital technology and how it is being used in products, facilities and training, I considered how these elements are changing theatre as a whole. Many opinions have been represented throughout this research regarding the role of digital technology within live theatrical productions. As technology is advancing and changing at a fast and seemingly impossible rate, integration is more about balance and strategy then trying to remain current. In my interview with Kent Thompson it was clear that the DCTC's approach to technology is driven by the needs of the show, not the latest technological tools. Using new technology whether it is new automation, the latest in moving lights or mind-

blowing projections is meaningless if it doesn't support or enhance the show. This show-driven approach attempts to provide the best possible experience to the designers, directors, performers and audience. Theatre has the ability to bring people together to share an experience, and while digital technology is not an indispensable component to this process, there are opportunities for using it to as a tool to engage the audience. It is important to the future of theatre that organizations address and explore this relationship between the performance and the audience. Organizations like the Denver Center are making great strides in experimenting in this new area, trying to maintain a healthy balance of tradition while keeping an eye on the possibilities of the technology of the future. Technology is not fundamentally changing the art of theatre but changing the process of making theatre and enhancing creative possibilities.

4.5 How are regional theatres integrating digital production technologies into productions?

Through my research I discovered that integrating digital technologies into productions is a multi-dimensional process that is unique to each organization. There is not a singular, all encompassing approach to integrating digital technology, but it is clearly vital that theatres develop processes and frameworks for relating to technology. Defining the needs of the productions, the organization, the audience and the community, and then developing a system that addresses these needs, is the most responsible approach to integration. A carefully crafted digital framework will outline the needs of the production, identifying technology that can fill that need, and understanding the impact that the technology has on the production and the audience. This process of integration signals that theatres might have to shift conceptions about currently defined roles and be more open and flexible in the process of theatre-making. Previously the design process for a theatrical production called together lighting, scenic, and sound, costumes, and props designers to address the needs of the production. This mix of

designers is changing, not just with the added area of projection, but with what the individual roles entail. In the future, it will be just as important to decide whether or not a show needs a set or lights, as it is today to determine if projections are needed. The integration of digital technology within production also could have potential impacts on breaking apart administrative silos. If a person is hired to create digital content to be used in shows, that same digital content could be used in marketing and outreach capacities to combine the currently independent efforts of administration and production staff. Theatre is adaptable, and has stood test of the time, but as we grow and evolve, it is up to responsible managers to ensure that the core of the intentions of the art are neither outshined nor confined by the technology of the day.

Chapter Five | Summary and Discussion

I draw this research to a close with a summary and discussion of the implications of integrating digital technology in modern theatre. Digital technology within theatrical production has a wide-reaching scope with a spectrum of implications and additional research opportunities. As I examined the benefits, drawbacks, potential, and opportunities of integrating digital technology into live performances, I realized the complexity of the impact that digital technology is having on the field. This study was intriguing because it didn't provide concrete answers, the issues, impacts and innovations are still emerging. This study provided evidence that regional theatres are gradually beginning to explore the possibilities presented by emerging technologies, and understanding the affect of emerging technology on the field.

When starting this research I anticipated that I would find some evidence of theatres implementing digital technology just to adapt to current trends, or to add spectacle. I was surprised to find that there was little evidence that this was a strong motivation for integration. I discovered that the decision-making process behind integration and implementation of digital technology in theatrical productions in predominately driven by the needs of the production. Theatres are asking the question: what technology is right or appropriate for the production we are presenting? This simple straight forward approach is sometimes clouded by debates surrounding digital technology versus live performance. In my opinion, digital technology is not a threat to live theatre but represents an opportunity. I challenge theatre professionals to critically examine their use of technology and, not to discard its potential uses due to fears of changes.

As digital technologies have emerged, so have the various opinions about its role in live performance. The new technologies being developed are not necessarily meant to replace legacy technology but to enhance productions. Modern theatre must find a balance that can embrace

current possibilities while honoring the traditions of the art form. As pioneering American theatre designer Robert Edmond Jones (1941) explained,

> Life moves and changes and the theatre moves and changes with it. By looking at the theatre of the past, we may come to see our own theatre more clearly. Theatre of every age has something to teach us, if we are sensitive and humble enough to learn from it (p.45).

Maintaining a balance of tradition and artistic intention at the heart of the creation process allows for any technology to be used to make ideas reality. For example despite experimentation with projections being used to create "sets", the majority of use is to enhance the scenic design, not replace it. I believe that we are living in a time of change where we have the opportunity to define what theatre means to our era. Digital technical components impact how we make theatre: the creation process, the delivery final product, as well as shape the audience experience. This research distilled three overarching topics for discussion: the shifting organization roles and production process, relationship between the audience experience and digital technology, and the role of the arts administrator in cultivating an organizational digital identity.

5.1 Organizational Roles and Production Process

Digital technologies are impacting every area within the structure of performing arts organizations. Introducing new technologies in one area of an organization can have reverberating effects on the rest of an operation. As detailed by Miles and Green (2008) the sites of innovation in the creative sector are the creative firm (organization), production or preproduction (creation process), product (performance), communication (marketing) and the user experience (audience reaction) (see Figure 4, Innovation Sites in the Creative Industries, Miles & Green, 2008, p.67).

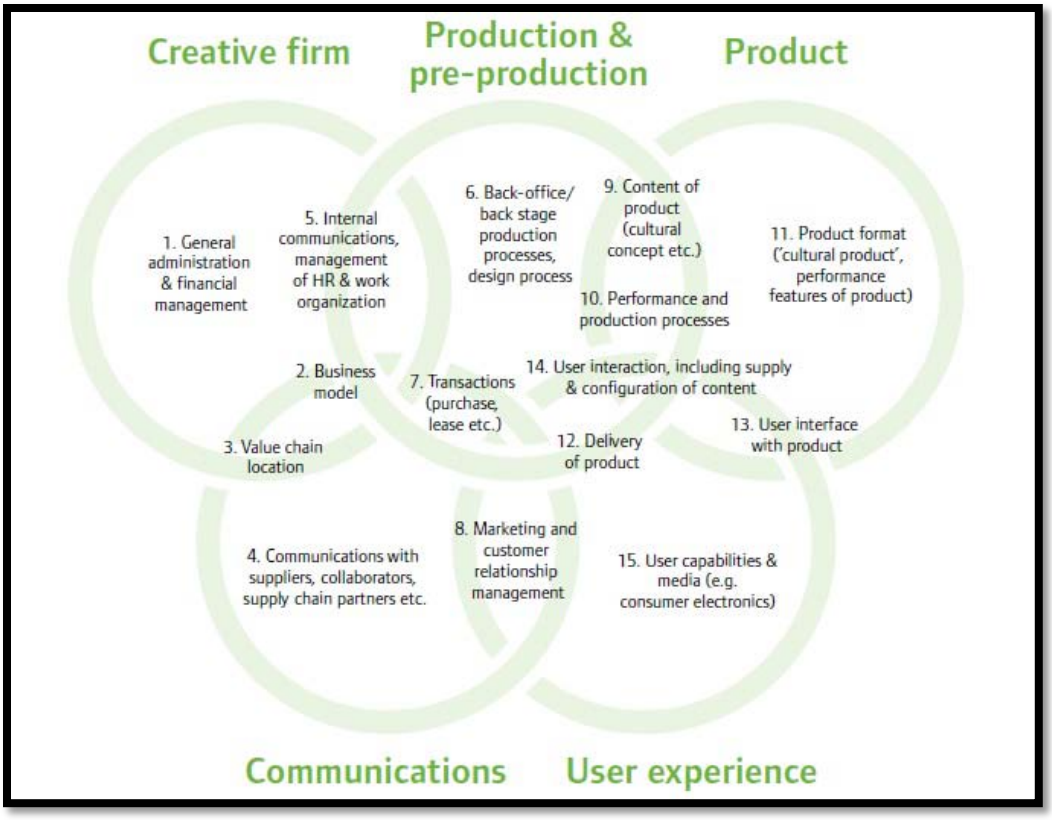

Figure 4 Sites of Innovation in the Creative Sector (Miles & Green, 2008, p.67)

Each of these areas overlaps and connects in complex and rapidly changing ways. The data regarding new products, trends, and approaches to digital technology ignites conversation surrounding the current organizational roles and the production process. Innovations in technology are creating new jobs, changing job titles, and job tasks or functions. The traditional role of designers, directors, performers or administrators with the creation process is changing to include new tasks and responsibilities. The DCTC is using the one Resident Multimedia Specialist position to fill many roles: marketing, creation, experimentation, and audience outreach. I believe this kind of restructuring of traditional roles is a positive move in breaking down the separation between administration and production responsibilities.

In addition to changing the way that organizations are structured, digital technology is changing the process of how we develop a production. Emerging technology is making the pre-

production much more efficient, but also increasing the creative potential of design as artists have more flexibility and the ability to quickly alter their vision. The idea of the "virtual tech", where designs can be created and altered in a virtual world before ever being built could significantly cut costs and save time (O'Neill, 2006). It will be interesting to watch in next few years how the technologies identified in this study in scenery, lighting, and projections, will inform the process of making theatre, the end product and the user experience.

5.2 Relationship to the Audience

Occasionally, throughout this research, I have mentioned the potential for digital technology to revolutionize the audience experience as well as audience engagement. I touched on how audience expectations are shifting as a result of digital saturation of everyday experiences. As audiences are exposed to more and more multimedia experiences in Broadway performances and concerts, they come to anticipate technological advancement in other art experiences. It was not the intent of this research to explore developments in engagement or address impact of technology on the overall audience experience; it frequently surfaced within my investigation, and presents many opportunities for future research. Many organizations are using "innovation in digital technologies to expand, and deepen their relationships with audiences…Digital technologies have potential to allow arts and culture organizations to achieve a step increase in their audiences…" (Bakhshi & Throsby, 2009, p.2). This attitude was reflected in the new programming being developed and the DCTC which aims to increase "engagement of audiences as active participants in process as well as product" (DCTC, 2010). Audiences are increasingly exposed to participatory experiences and are less satisfied with passive entertainment.

The industry must learn how to use digital technology as a tool to create new ways of experiencing performances, while still maintaining the artistic vision in the performance. Audience is a main component of live theatre, as an article written over twenty seven years ago predicting the future of theatre hypothesized:

> The theatre of the future will depend more on accepting the living presence of the audience spectator… in the sense of the entire theatrical event is only happening because the audience is there, because the audience and the event truly touch each other at the moment of the performance (Schneider, 1984, p.17).

It is the job of theatre professions to ensure the unique experience is kept intact but explore how new technologies fit into this relationship and emerging societal needs.

5.3 Arts Administrators Creating Digital Identities

As I approached this research in the context of an Arts Administration environment, I would like to connect my findings to the role of the arts leaders. As an arts administrator there is an inherent responsibility to the mission, the community, the artists, and the work that the organization produces. Frameworks, policies and procedures addressing technology use should be developed as we are figuring out what technology means to our individual organizations and fields. Creating this digital identity will establish a system of checks and balances to ensure that technology is upholding and enhancing mission and not overwhelming or overshadowing performances

The death of theatre has been predicted since the invention of the motion picture but is and has always, "been reborn, Phoenix-like at the very moment we have finished conducting the funeral service over its ashes" (Jones, 1949, p.131). I cannot predict the future or what theatre might mean to future generations, but it is my belief that we are in an exciting time of redefining the arts. Modern theatre-makers have the opportunity to make relatable, thought provoking, and visual stimulating experiences for 21st century audiences. New theatrical experiences can be

created by blending the excitement and tradition of live performance with innovative new digital technologies. This research documents the current trends and attitudes in regional theatre towards digital production technology. It is my intention that this work will incite dialogue about its uses, developing a digital identity for theatre in modern America, and the importance having open discourse for the future of theatre as an art form.

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APPENDIX A | Document Analysis

Case Study: Code: IN (innovation), IM (impact), IT (integration)

Key Theme: Document Location: (public/private)

Date:

Document Type: _____ Report, Article, Book _____ Government Documents

_____ Arts Organization's Records ____ Job Descriptions

_____ Online Information ____Online Information

Author/Creator:

Summary:

Coding	Information	Notes

APPENDIX B | Interview

Case Study: Code: IN (innovation), IM (impact), IT (integration)

Key Theme:

Date: Interview Location:

Participant Background:

Consent: ___ Oral ____Written ____Audio Recording ___ OK to Quote

Interview Context:

Coding	Information	Notes

APPENDIX C | Case Study Interview Questions

1. Do you tend to rent or buy new equipment? Describe the process of this decision making? And what is your typical budget for rental equipment per show?

2. Do you have a separate or additional budget for technology purchases?

3. Have you renovated your space? In what ways? Why?

4. How does working with trade unions impact your decisions about technological innovations?

5. Do you use projections in your shows, if so how many in your season?

6. Do you typically include a projection designer in your production team? If so when did you start?

7. What was your most recent upgrade in technology? How much did it cost? Was there any training that took place with the new system?

8. Does a certain production department (lighting, scenic, special effects, sound) have preference when spending on innovation?

9. Does your theatre use automation in productions? What control system do you use?

10. Describe your lighting system/console/software?

11. How many moving lights do you own? How many led lights?

12. If you could invest in a new development in production technology what would it be?

13. Do you provide training for employees for new production technology?

14. How do you integrate new and old technologies? Do you consider it successful?

15. How important is it to your organization to integrate the latest technologies into your productions?

16. Describe the role that digital technology fills within your production (spectacle, storytelling, etc)?

17. Do you attend production technology conferences or trade shows? (LDI, USITT)

18. Do you see a correlation between amount of new technology in a production and audience interest?

19. How do you see the future relationship between digital technology and theatre emerging?

20. On a scale from 1 to 5 (5 being the highest) rate the importance of new technology to your organization? Can you describe this importance?

APPENDIX D | Survey Questions

1. What is your organizations average production budget?
2. How many shows are in your season?
3. Do you tend to rent or buy new equipment?
4. What is your typical budget for rental equipment per show?
5. When was your venue built?
6. Have you renovated your space for technological purposes?
7. What was the last piece of new production technology you purchased? For lighting? For sets? For sound? For projections?
8. Does a certain production department (lighting, scenic, special effects, sound) have preference, when spending on innovation?
9. Does your theatre use automation in productions? What control system do you use?
10. What lighting system/console/software do you operate?
11. Do you use projections in your shows, if so how many in your season?
12. If you could invest in a new development in production technology what would it be?
13. Do you provide training for employees for new production technology?
14. Do you attend production technology conferences or trade shows? (LDI, USITT)
15. On a scale from 1 to 5 (5 being the highest) rate the importance of new technology to your organization?
16. Do your new systems and old systems of technology work together?

APPENDIX E | Recruitment Materials

Case Study Recruitment Email

Dear [*insert name*],

My name is Kelly Johnson and I am a graduate student from the Arts and Administration Program at the University of Oregon. I am writing to invite you to participate in my master's research project which will investigate innovations in digital theatre technology. I have been studying different innovations in production technologies and the ways that they are impacting 21st century theatre. I have limited my study to regional theatres in the United States. I would like to explore your organization as a case study of how theatres are approaching this integration process. You're eligible to be in this study because you a nonprofit regional theatre. I obtained your contact information from [*describe source*].

If you decide to participate in this study, you will be interviewed regarding your organization, what types of digital technology your organization uses, how you integrate new and old systems and similar queries. I'll use the information to enhance and support my review of literature and other research data to form my analysis and conclusions about the state of technology in the field. The interview will take approximately one hour and with your permission will be audio-taped. After the initial interview, it is possible I will contact you with follow-up questions, either over the phone or email (according to your preference and availability). Remember, that participation is completely voluntary. You can choose to be in the study or not. If you'd like to participate I will send you the consent forms via email. If you have any questions about the study, please email or contact me at kjohnso9@uoregon.edu . Thank you very much.

Phone/ In person Recruitment Script

My name is Kelly Johnson and I am a graduate student from the Arts and Administration Program at the University of Oregon. I wanted to invite you to participate in an interview about your background and experience with digital production technology and because your organization has demonstrated an interest in examining the theatre and technology relationship. I hope to learn about innovations in digital theatre technology, integration processes, and impact on the art of theatre making. You're eligible to be in this study because your association with a nonprofit regional theatre. I obtained your contact information from [*describe source*].

The interview will take approximately one hour and with your permission will be audio taped (for transcription purposes). I will use this interview alongside a survey sent to one hundred regional theatres to map recent trends in the field of digital production technology in the county. I may include information from this interview in my master's research project. It is possible that I will contact you after the initial interview with follow-up questions, either over the phone or via email (according to your preference and schedule). Remember, that participation is completely voluntary. You can choose to be in the study or not. If you'd like to participate I will send you the consent forms via email. If you have any questions about the study, please email or contact me at kjohnso9@uoregon.edu .

Survey Recruitment/Consent Email

My name is Kelly Johnson and I am a graduate student from the Arts and Administration Program at the University of Oregon. I am writing to invite you to participate in my master's research project about innovations in digital theatre technology. My study is focused on regional theatres, which for the purpose of my research includes nonprofit theatres that are members of either the Theatre Communications Group or the League of Resident Theatre Companies. You're eligible to be in this study because you represent a regional theater in the United States. I obtained your contact information from [*describe source*].

You are invited to participate in a survey about your organizations use of digital technology within productions. I hope to learn about innovations in digital theatre technology, integration processes, and impact on the art of theatre making. I will use this survey alongside an in-depth case study of one location to map recent trends in the field of digital production technology in the county. I may include information from this survey in my master's research project.

If you decide to participate in this study, please complete the following survey. The survey should take at maximum twenty minutes of you time. The first question will act as your consent and understanding of participation in my study. I'll use the information gathered to enhance and support my review of literature and other research data to form my analysis and conclusions about the state of technology in the field. Survey results will be included in my final master's research project. Remember, this is completely voluntary. You can choose to be in the study or not. Please feel free to leave any questions that you deem inappropriate blank. Job titles will be used in my project but organization names will be removed for my final document. If you have any questions about the study, please email or contact me at kjohnso9@uoregon.edu . Click the following link to continue to the survey. *[insert link here]*.Thank you very much.

APPENDIX F | Consent Form (Case Study/Interview)
(email and in person)

Title of Project: Theatrical Productions and Digital Technology: Innovations in and Implications of digital production technology in regional theatre.

Investigator: My name is Kelly Johnson, and I am a student member at the University of Oregon in the Arts and Administration Program. I am investigating innovation in digital production technologies, and how they are changing the theater landscape. I can be reached 720-318-9778 (cell) or by email: kjohnso9@uoregon.edu

Invitation to Participate: You are invited to participate in an interview about your background and experience with digital production technology and because your organization has demonstrated an interest in examining the theatre and technology relationship. I hope to learn about innovations in digital theatre technology, integration processes, and impact on the art of theatre making. The interview will take approximately one hour and with your permission will be audio taped (for transcription purposes). I will use this interview alongside a survey sent to other regional theatres to map recent trends in the field of digital production technology in the county. I may include information from this interview in my master's research project. It is possible that I will contact you after the initial interview with follow-up questions, either over the phone or via email (according to your preference and schedule).

I agree for this interview to be recorded via audio means_____ (initial)

Your words : I may refer to something you say or include a direct quote in a publication I write on this topic. Please specify how you would prefer to be identified. **I grant you permission to: (please check appropriate lines)**
_____ use my real name as follows_____
_____ use only my first name as follows_____
_____ use the following pseudonym_____
_____ use only job title as follows_____
_____ do not use any identifiers

I assure you that I will respect your requests, and that I will do everything possible to maintain your confidentiality as specified by you above.

Participation is voluntary: Participation in this research is voluntary. You may discontinue participation at any time and refuse to answer any questions that you feel are inappropriate or make you feel uncomfortable. If you participate in an interview and later change your mind about being included in lectures or publications, please inform me, and I will not use any data that I have collected from you. I will also destroy any recordings of the interview upon your request.

Benefits: Your participation will contribute to knowledge about the methods and approaches that regional theaters applying to integrate digital technology in theatrical productions.

Your Rights: Before the interview, I will explain this form and ask you to sign it. By signing it, you grant me permission to use information gathered in academic presentations and publications. You will then be offered a copy of this document.

If you have questions about your rights or feel that your rights as a participant in this research have been violated during the course of this project, you may contact the University of Oregon Office for Protection

of Human Subjects, Riverfront Research Park, 1600 Millrace Drive, Suite 105, 5237 University of Oregon, Eugene, OR 97403-5237, (541) 346-2510 (phone), (541) 346-6224 (fax)

Your signature indicates that you have read and understand the information provided above, that you willingly agree to participate, that you may withdraw your consent at any time and discontinue participation at no risk to yourself, that you have received a copy of this form, and that you are not waiving any legal claims, rights or remedies.

Participant's Name (please print) _____
Signature_____ Date_____
(if received via email understand that typing name will be the equivalent as a signature)

Investigator's Signature_____Date_____