Ready for Launch: How UVA's Computer Science Department Might Benefit From Forge's Bootcamp Training Model
(Technical Paper)

How Special Effect Technology is Changing the Performance Art Industry
(STS Paper)

A Thesis Prospectus
In STS 4500
Presented to
The Faculty of the
School of Engineering and Applied Science
University of Virginia
In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science in Computer Science

By
Jeffrey Lionel Mouritzen

December 9, 2022

On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

ADVISORS

Kent Wayland, Department of Engineering and Society

Briana Morrison, Department of Computer Science

General Research Problem: Understanding How New Digital Technologies Alter Existing Societal Infrastructures

How does society adapt to new, innovating digital technologies in well-established industries, and how can one be prepared for such adaptations?

Throughout the entire history of mankind, performance art and theatre have planted themselves as a stable pillar of society, allowing for unparalleled dramatic storytelling, information dissemination, and entertaining spectacle. It is such a deeply rooted societal entity that it sparks its own discipline of performance and entertainment theory, giving way to a greater understanding of how performance impacts and molds society, as well as how society molds and develops performance. With such an engrainment in society, it is only natural for performance art to play something of a symbiotic dance with the technology that evolves along with society. Despite the involvement of technology with performance art being nothing overly new or inherently innovating, the significant acceleration in digital technologies in the past few decades has led to a new debate on how eager classical performance arts should be to adapt to these new special effect capabilities, such as advancements in "set-design, projection and video art, and lighting" (*How Technology Has Changed Theater*, 2020), as over-development may potentially render them inauthentic to those viewing the theatre as a sacred, categorically human space. The STS portion of this paper will explore the nature of these controversies, to investigate how these technologies have changed the world of theatre and challenged the notion of what is deemed "classic" performance art, as well as how society has adapted to those changes.

This technical topic, on improving curriculum to better suit entry-level industry requirements, also raises the subject of a technologically fluid industry through the exploration of the drop off in industry-applicable computer science (CS) experience from the UVA Engineering

School, versus the efficient and innovative hands-on training model adopted by programs (such as Forge's Launch program) dedicated to contemporary real-world experiences. This portion will detail how universities might benefit from the model of internship preparation and industry training so that they may improve and optimize their own curriculums, for the ultimate purpose of better preparing students for the ever-changing industries based in computer science and digital technologies (including the evolving entertainment industry).

Technical Report: Improving UVA's Computer Science Curriculum to Better Prepare Students For The Industry

How might UVA's Computer Science Department benefit from Forge's bootcamp training model to better prepare students for internships and industry work?

The industry of software and computer science is one prone to significant and frequent developments, both technically and socially. Not only is it an ever growing industry, it is also one that is becoming significantly more complex and competitive as the technology becomes more advanced with every passing year. Students of the discipline, particularly those in higher education, must adapt and gain experience far earlier in their careers—in addition to simply graduating with a degree—if they want to stay ahead and compete for the jobs they want. With this in mind, most graduating students, about 57% of the students who begin at least an entry-level job out of college (Morgan, 2021), strengthen their resumes with valuable internship experiences. Internships, being a "tried-and-true method for less-experienced students to get their foot in the door" (Radermacher, 2012), are generally fantastic areas for the application of skills obtained by CS students, but are notoriously poor at providing the time and resources to outright teach these fresh-to-the-industry students the skills they need to use. Higher level university

education curriculums, by contrast, teach students the foundational skills, knowledge, and computation theory that students need to understand and practice computer science, but fall short in terms of preparing students for immediate application of their skills in more specific software development workplace roles, leading recent graduates to "often fail to meet industry expectations when they first enter the workforce" (Conde, 2021). There is a present desire from students for the perfect middleman—an entity that can teach and guide them into the industry. The question then arises: why doesn't higher education meet this need? What tangible things might the university experience and curriculum do to better prepare students for the real world?

This report will deconstruct the shortcomings of the CS curriculum as it currently stands in the way it serves students' transition to industry. It will first assess the composition and pacing of the standard CS curriculum, and evaluate the benefits and tradeoffs of pushing more specialized CS disciplines and subjects to later points in the student's academic experience. It will take into account where student priorities lie when it comes to becoming well-rounded in theory versus proficient in hard programming skills, and what works best in terms of being able to readily apply what they know in the industry. To give an example of what this looks like to one who might not know the CS curriculum, the report will consider classes like Theory of Computation and Discrete Mathematics. These are foundational classes required for CS students, typically in their second or third year, before they can move on to specialized classes (such as Operating Systems, Software Testing, Cloud Computing, Cybersecurity, and Mobile App Development to name a few). However, despite being stressed as critical subjects to take, such theory-related required classes often don't teach the specific tools and programming skills students need as they begin to intern and work, which for many students begins roughly around that time. They instead teach more abstract theories that, while useful in further scientific

research, may not be directly applicable in a student's immediate transition to the software development industry. In order to explore the extent of this disconnect, and understand the experiences of the students as they navigate the CS curriculum, research for this topic will refer to qualitative data collected from course evaluations and ratings, course statistics, and other reflections written by students in undergraduate programs and program graduates who have since entered the industry. Written reflections will be particularly valuable here, so one might understand the extent to which students and graduates felt supported in the industry thanks to the required classes on theory, as well as the overall curriculum structure.

Additionally, the report will assess class syllabi to cover how the university encourages (or alternatively discourages) project collaboration at each level of the academic progression, and how that may influence how comfortable and effective students are in the team-based workplace culture of standard software development companies, a culture that describes software engineering as an “inherently collaborative social practice” (Mistrík, 2010). It will cover the disconnection issues university culture has with this industry culture regarding collaboration, and use the curriculum evaluations to provide potential suggestions on how to make the curriculum more faithful to the real industry experience.

Lastly, the report will explore the rise in internship programs, such as Forge’s Launch program, that stress industry preparation and training and with the very hard skills and tools that professionals in the workforce utilize daily. The report will use intern testimonials to discuss what, qualitatively speaking, these programs do best in terms of providing experience in application, and will demonstrate why the model implemented by these programs is something universities may look to in improving their own curriculums, so that they too might be able to better prepare students for the developing and innovating world of computer science.

STS Report: How Special Effect Technology is Changing the Performance Art Industry

How is special effect digital technology changing the performance art industry, and how are theatre professionals and audiences alike adapting to and molding how such technology is ingrained into the mainstream?

While the incorporation of technology into theatre is nothing new—it is a well-documented phenomenon from the introduction of microphones and speaker systems to the proliferation of advanced rigging and set automation—there has been a noticeable uptick in the development and incorporation of technology into the arts throughout the past few decades. New technologies are being used in innovative ways by traditional theater companies and organizations to take the traditional art form in fresh, previously unexplored directions. Such new technologies include anything from digital lighting, cueing tech, and projection art, to the emerging "newer" technologies of virtual reality (VR), augmented reality (AR) and mixed reality (MR) (Rogers, 2019). Some of the high-profile companies experimenting with these technologies include National Theatre and Royal Shakespeare Company, companies that have been known for their high quality mainstream theatre and are symbolic of how drastically the traditional theater industry is evolving and constantly being challenged.

However, as exciting as these new technologies and adaptations are to innovative creators and enthusiastic audiences, there are proponents in the industry, particularly professionals in dramaturgy (the study of the theory and practice of dramatic composition), that discourage and criticize this transition to a more digitized theatre on the grounds of it's dehumanization of the art and diversion from the original artistic intent of traditional theatrical pieces. The underlying notion of this debate, one that regards authenticity in the performance industry, goes beyond the

specific technological innovations, and instead applies to technology integration into theatre as a whole. To contextualize this debate, this report will explore the conflict and controversy that exists where a technology, or a series of technological systems, threatens to "dehumanize" the art, using historical examples from the 1960s to help set the stage for what we might be seeing happen concurrently.

In this context, "dehumanizing" the art refers to diverging from organic traditional theatre (that is, theatre built around the "human" aspect with minimal technical or spectacle distraction) to the point where there is a subjective loss of authenticity. Dehumanization is especially apparent in theatre works considered "classics", where the original artistic intent forgoed the use of spectacle and technology, and instead focused on the actors, dialogue, and actions. It was during 1960s that societal and cultural mini-movements were organized to rehumanize theater by stripping it from the technical elements that proliferate "dead theater", a word coined by disapproving artists who saw the inclusion of technologies within the theater as "cold," "technical," and "slick," (Gray, 2014). This report will utilize that context to investigate whether similar movements are present in today's culture, with the introduction of digital technologies on the theatrical stage. To help with this investigation, evidence will be derived from the varying social actors involved with the entertainment and performance art industry, ranging from theatre critics and enthusiasts, to the innovators behind the most modern pieces of immersive theater digital technology.

In addition, the report will discuss the tangible impact and correlation of mainstream "commercial" theater, such as theatre produced by the mainstream companies National Theatre, Royal Shakespeare Company, and even Broadway itself, on the drive toward technological innovation in the theater. While the invention and proliferation of new technologies continue to

develop new innovative theatrical productions, there is conversely a phenomenon in which the mainstream theatre drives the technology itself in new and interesting ways. For example, the trend toward incorporating video projection art technology into staged productions has led to the rise of projection-mapping software such as Troikatronix Isadora—digital technology intended specifically to aid with the unique ways mainstream theatre uses video projection in and on their set designs. In this example, the performance art industry took a technology that was previously used in cinema (video projection), and developed it to meet the needs of live performance. Researching the documented factors impacting the divergence of mainstream theatre and cinema may give further insight into the mutual shaping of the entertainment industry with new digital technologies.

A primary method that will be utilized to research the complex developing relationship between theatre and technology will be to conduct interviews with artistic directors and staff members of theatrical productions that have had experience incorporating innovative, digital technologies into their work. The goal of such interviews will be to first confirm that there was such a substantial technological transition as of late, and then to understand how abrupt or drastic the transition may have felt, both by the production itself and by those who consume the art. Other relevant sources to consult may include critic writings and other forms of broader theater criticism. The general idea is to get a full image of how those industry-involved social actors adapted to and molded the integration of modern digital technologies into the theatre world, or alternatively how the integration of such technologies influenced how society perceives and classifies authentic, classic theatrical works.

Conclusion

The overarching question that this portfolio of research will cover will be on the basis of how our society adapts to an evolving changing technological landscape, particularly with a focus on digital, computer based technological systems. This would come in two parts, the first being a discussion on how students and newcomers to the computer science industry can be best prepared to adapt to the evolving landscape, and the second being an investigation of how such an evolving landscape influences and molds traditional social customs and practices within the entertainment and performance art industry.

References

Conde, J.; López-Pernas, S.; Pozo, A.; Munoz-Arcentales, A.; Huecas, G.; Alonso, Á. (2021). Bridging the Gap between Academia and Industry through Students' Contributions to the FIWARE European Open-Source Initiative: A Pilot Study. *Electronics* 10(13), 1523. https://doi.org/10.3390/electronics10131523

Dodge, Sarah. (2021). Forge Academy Reviews [testimonial blog posts]. https://joinforge.co/reviews.

Gray, Matt. (2014, April 14), Building a Better Response: On the Tenuous Relationship between Theater and Technology. *Los Angeles Review of Books*. Retrieved from https://lareviewofbooks.org/article/matthew-gray-explores-historically-distrustful-relationship-theater-technology/.

Guyot, Sylvaine, and Jeffrey S. Ravel. (2020). Introduction – Digital Technology and Theater History. In *Databases, Revenues, & Repertory: The French Stage Online,* (1680-1793). https://doi.org/10.21428/671d579e.97f1276c.

"How Technology Has Changed Theater." (2020, 14 July). *Illuminated Integration*. Retrieved from https://illuminated-integration.com/blog/how-technology-has-changed-theater/.

Mistrík, Ivan & Grundy, John & van der Hoek, Andre & Whitehead, Jim. (2010). *Collaborative Software Engineering*. Springer.

Morgan, Kate. (2021, September 20). Why inexperienced workers can't get entry-level jobs. *BBC Worklife*. Retrieved from https://www.bbc.com/worklife/article/20210916-why-inexperienced-workers-cant-get-entry-level-jobs.

Radermacher, A. (2012). Evaluating The Gap Between The Skills And Abilities Of Senior Undergraduate Computer Science Students And The Expectation Of Industry. [Master's Thesis, North Dakota State University]. https://library.ndsu.edu/ir/bitstream/handle/10365/26744/Evaluating%20the%20Gap%20between%20the%20Skills%20and%20Abilities%20of%20Senior%20Undergraduate%20Computer%20Science%20Students%20and%20the%20Expectations%20of%20Industry.pdf?sequence=1&isAllowed=y

Rogers, Sol. (2019, December 6). How Technology Is Augmenting Traditional Theater. *Forbes*. Retrieved from https://www.forbes.com/sites/solrogers/2019/12/06/how-technology-is-augmenting-traditional-theatre/?sh=280cf6fe50c0.