

## Recanonizing “American” Sound and Reinventing the Broadway Song Machine: Digital Musicology Futures of Broadway Musicals

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Two decades ago, on November 11, 1997, a *New York Times* article entitled, “Undiscovered Bach? No, a Computer Wrote It,” reported a human-machine contest in the field of music composition—the first such case the world had ever witnessed. A music theory professor at the University of Oregon, Dr. Steve Larson, competed with a computer to compose music in the style of Johann Sebastian Bach, and, startlingly at the time, lost the contest to the computer. All the listeners decided that the piece composed by the computer named “EMI” (Experiments in Musical Intelligence, pronounced “Emmy”) was genuine Bach. The man behind EMI, computer scientist and composer David Cope, was able to use 1990s technology to have a computer analyze samples, use pattern-matching algorithms to compile a “dictionary” of the musical “words” Bach liked to use (characteristic chords, melodies, and rhythms, along with rules of syntax) and then cherry-pick the pieces he decided

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that sounded the most like Bach.<sup>1</sup> Now, twenty years later, could the same thing happen to Broadway musicals? Could a well-designed computer program that knows all the quirks and tricks of writing a popular Broadway number beat a flesh-and-blood composer in creating genuine-sounding hit Broadway songs? The answer seems to be a predictable yes. In the past two decades, digital musicology, music information retrieval (MIR), and machine learning have developed to such an extent that music pattern recognition is now a recognized field of study in computer science. A large enough grant that puts together a team of top computer programmers and musicologists can make wonders happen. In fact, such an endeavor, supported by major grants, has already come to fruition. In February 2016, London's West End premiered the world's first computer-generated musical, *Beyond the Fence*.

In this chapter, starting with *Beyond the Fence*, I introduce the technology behind the world's first computer-generated musical and the current advancement of digital musicology, which make possible what I call the Broadway Song Machine, or a comprehensive set of secret formulas detected in hit tunes of Broadway musical canons. I argue that the Broadway Song Machine is not a rigid and unalterable set of formulas. It is contingent upon what constitutes Broadway musical canons, which constantly evolve and change—particularly so in the face of new technology and methodology in the digital age. I argue that the canonization and reCanonization processes of Broadway musicals are crucial to the making of “American” sound in the past and present, and the prediction of what it would be in the future. I thereafter critically explore the reCanonization processes of Broadway musicals in the digital age and suggest ways that “American” sound should be reCanonized, and the canons diversified.

#### TECHNOLOGY BEHIND THE WORLD'S FIRST COMPUTER-GENERATED MUSICAL

Commissioned by the art-oriented television channel Sky Arts, *Beyond the Fence* began at Cambridge University, where researchers from the Machine Learning Group analyzed thousands of musicals to determine what makes a hit or a flop. They decided that the following elements make a hit musical: romance or death (or both), a female lead, a story set in Europe, and a happy ending. The project was then transferred

to Goldsmiths at the University of London, where researchers used the “What-If Machine,” a three-year project that received funding from the European Union and involved teams at five institutions, to generate central premises. The aim of the “What-If Machine” was to build a software system that is able to “invent, evaluate and present fictional ideas with real cultural value,” and take on creative responsibility in arts and science projects.<sup>2</sup> After discarding many what-if style ideas built on combining topics in surprising ways, the “What-If Machine” derived the central premise for the musical: “What if there was a wounded soldier who had to learn how to understand a child in order to find true love?” From there the project moved to the Complutense University of Madrid, where a computer system called PropperWryter, developed by Professor Pablo Gervás, took over the task of building a core narrative arc. Set in UK in 1982, *Beyond the Fence*, a new musical about “hope, defiance, unity and love,” tells the story of a mother (Mary) and her mute daughter (George) who protest in a peace camp against the arrival of US cruise missiles. When Mary is about to lose George to the authorities, she finds an unlikely ally in a US airman (Jim Meadows). Mary is thus faced with choosing between doing what is best for George and staying true to her own ideals.<sup>3</sup>

After the computer decided the setting, the plot, and the narrative arc, human writer/composer duo Benjamin Till and his husband Nathan Taylor, best known in the UK for broadcasting their wedding as a musical, called *Our Gay Wedding: The Musical*, wrote most of the book and lyrics. Till and Taylor conscientiously chose a historical background pertinent to the world affairs today. Greenham Common Women’s Peace Camp (1981–2000) was first established to protest against the placing of nuclear weapons as well as the arrival and siting of cruise missiles at Royal Air Force Greenham Common in Berkshire, England. Tens and hundreds of women protesters entered, disruptively and subversively, what had been usually considered “masculine” spaces. Many of these women were mothers who stood up for the safety, peace, and human rights of their children and future generations, resembling the Women’s March in January 2017. While protesting, these women cut down parts of the circumferential fence of the Greenham Common, and attempted to seal off the base. In the musical, the “fence” is that between the protesters and the army, and as the story evolves, the audience is able to see the action from both sides. An *Independent* review calls the Greenham setting “the thing that makes it zing.”<sup>4</sup> Apart from Mary, George, and Jim, other key

characters include Margie, who mothers the camp; Helen, a girl with a weight problem who has trouble finding her feet and her confidence; and Ceridwen, a heterosexual woman who finds the “No Men” policy at the camp to be very difficult. Act I builds up to a high-energy song and dance, “At Our Feet,” when the Berkshire Truancy Officer threatens to take George away. Act II closes with a reenactment of the historical event in December 1983 when 50,000 women circled the base and protested.

The music was mostly composed by Android Lloyd Webber and the FlowComposer system. Android Lloyd Webber is a computer composition system created by Dr. Nick Collins from Durham University, based on a machine-listening analysis of musical theatre music. The FlowComposer system is a research project funded by the European Research Council (ERC) and coordinated by François Pachet, the Director of the Sony Computer Science Laboratory in Paris.<sup>5</sup> The algorithmic compositions that Android Lloyd Webber and FlowComposer generated were then curated and arranged by Till and Taylor into 16 musical numbers. Producer Christian Gale declared to *The Guardian* that the project “is not about taking humans out of the creative process at all.”<sup>6</sup> It is true that while computer programming started the project, human beings were the ones who put it together. A talented ensemble of live actors performed the show.

The reviews for the show were generally positive. A *Telegraph* review on February 27, 2016 called *Beyond the Fence* “no mean feat ... in a world where flops are the norm.”<sup>7</sup> An *Independent* review claimed: “Despite my reservations I was won over.”<sup>8</sup> Reviewers mostly found the music enjoyable and fun, making references to previously hit musicals. A review in *Londonist* remarked: “It’s quite fun to try and spot stuff the tech has re-purposed: a bit of *Chicago* here, a bit of *The Lion King* there.”<sup>9</sup>

Despite many reports and reviews on the world’s first computer-generated musical, there was little coverage on the technology behind the computer composition system, how the system detected formulas of hit songs, what tools were used, and which songs were analyzed. This leads to a series of questions this chapter explores: What are the state-of-the-art digital approaches to analyzing music that enable modeling after hit musicals? What is the status quo of digital musicology today? How can these advanced technological inventions be applied to Broadway musicals?

## DIGITAL MUSICOLOGY STATUS QUO

Digital musicology is the study of music—both music per se and music-related information—using applied computational and informatics methods. To obtain music-related information, researchers consult collections of bibliographic data, socio-historical and biographic information, and performance ephemera, much of which are in the process of being digitized with inventories or finding aids accessible to the general public. For instance, the New York Philharmonic Digital Archives, funded by the Leon Levy Foundation, has digitized printed performance programs, business records, and photos, in addition to marked music scores and marked orchestral parts.<sup>10</sup> In order to “mak[e] its own contribution to the Open Data movement,” New York Philharmonic makes its data “available for study, analysis, and reuse.”<sup>11</sup> It offers open-source performance history metadata—the information about performance history data, such as program ID, full orchestra name, season number, location, venue, date, and length of concert. Metadata, here available in XML and JSON, provides shortcuts to finding and working with particular instances of data.<sup>12</sup>

In terms of music per se, the crux of digital musicology, two main approaches guide the research: analysis of scores and analysis of audio files. Large collections of scores already exist, for instance, OCVE (Online Chopin Variorum Edition), funded by Andrew W. Mellon Foundation, provides a large amount of digital images of manuscripts and first editions of selected works by Chopin. The Juilliard Manuscript Collection offers 140 items of priceless autograph and working manuscripts, sketches, and first editions, which are of great interest to performers and scholars.<sup>13</sup> Stanford University’s Center for Computer Assisted Research in the Humanities offers Digital Resources for Musicology (DRM), a website that links to substantial open-access projects and repertoires, some of which provide audio collections under “Historical Audio and Video.”<sup>14</sup> Harvard University offers a complementary mix of projects at Online Resources for Music Scholars (ORMS).<sup>15</sup> Not surprisingly, the existent well-funded digital databases tend to house Western music, especially European classical music. Up till now, there is no open-access digital archive that offers digitized music scores of Broadway musical theatre. Building such an archive would be crucial in applying digital musicology to the analysis of Broadway musicals. Since selected vocal scores—scores that consist of only two parts,