

Submission: Digital Studies/Le champ numérique

GameSound, Quantitative Games Analysis, and the Digital Humanities

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Introduction

It may seem like a natural impulse for scholars to break down a videogame into its component parts in an attempt to better understand it. Many of these scholars are gamers themselves, after all, and the act of play implicitly invites this sort of systematic deconstruction. As they delve into a game, a player accumulates rules knowledge, acquires in-game resources, and develops a tacit understanding of what the game asks of them, slowly inching toward a thorough understanding of the entire play experience. Only through this aggregation of materials and awareness can they improve their performance within the game, eventually completing certain objectives or beating it entirely.

For an academic, this type of mastery can take a different form. Instead of forging a better understanding of the game through play (as intended by the developer) technically-minded scholars can divide the play experience into small pieces that can be arranged and rearranged to facilitate study. This process can be as simple as playing a game methodically without completion strictly in mind - a process which often manifests itself through targeted or repeated plays - or can involve delving deeply into a game's code structure in an attempt to peek behind the curtains to learn how the title's various inner machinations reveal themselves through play. It is the latter that we are interested in exploring within this paper. By examining game assets from the purview of programmer or designer, rather than simply a player, we believe that scholars have the opportunity to view a game in its entirety - not just as a series of vignettes or set pieces put forth by the original game developer. Additionally, when broken into parts, commonalities across various titles may become easier to identify. Broader patterns - whether present in game text, audio, code, or something else entirely - can be revealed through the adoption of both established and emerging forms of quantitative analysis.

In this paper, we will first discuss our own experiences with quantitative game analysis by summarizing the first year of development of the prototype ludomusicological database, GameSound. We will also take a brief look at the works of Jason Bradshaw and Dr Adrienne Shaw, who are utilizing

intriguing types of quantitative analysis in their projects *BioShock Infinite and Feminist Theory: A Technical Approach* and *The LGBTQ Video Game Archive*, respectively. Finally, we hypothesize where this research could lead in the future: both for ourselves with GameSound and for other projects in the same vein of research.

Project Summary

It would be difficult to discuss GameSound without first briefly touching on the academic field that stands behind it, ludomusicology. An emerging sub-discipline of musicology, ludomusicology focuses on the academic study of the audio experienced in videogames. Primarily concerned with the direct study of a videogame's music and sound effects, ludomusicology also interrogates how we study audio within the context of digital software. Like many fields associated with the digital humanities, ludomusicology traverses disciplines: fostering collaborations with computer science, film and media studies, and communications.

GameSound is our first foray into quantitative videogame analysis and ludomusicological research and was conceived as a digital humanities class assignment at McGill University. The project was developed with a fairly broad goal in mind - to reveal the music and sound effects present within videogames in an effort to facilitate new forms of academic research. Embracing an interdisciplinary approach for categorization and display, and with usability at the front of our minds, we created GameSound's initial database as an online resource: one containing over two thousand individual audio files which could be filtered using a wide array of technical and musicological data. Designed to be accessed through almost any type of web browser, our hope was to allow scholars to explore videogame audio files by adjusting a handful of key parameters, ranging from file duration to ludomusicological classification.

The ultimate goal for the database is to include videogames from different platforms and eras, but the initial dataset focuses entirely on the sounds found within the 2005 computer game *Civilization IV*.

Civilization IV was chosen for the prototype for three main reasons: One, it possesses an incredibly open programming architecture in which developers have enabled transparent access to the game's assets - making both data extraction and interpretation simpler than in comparable titles. Secondly, *Civilization IV* was the first computer game to be nominated for (and win) a Grammy, granting it a special place in the history of ludomusicology while affirming a certain level of cultural significance. Finally, the title's availability across various platforms and marketplaces ensured that we could acquire the game without having to seek out additional hardware. In contrast, games that are exclusive to a specific era or console could have presented severe challenges in both acquisition and access to game assets.

The technical execution of GameSound is facilitated by HEURIST, a free platform for scholars in the digital humanities that enables online database construction, mixed-media assets, and dynamic data visualization. Like many digital humanities tools, HEURIST pursues a certain level of accessibility for its user base:

HEURIST's research-driven data management system puts the user in charge, allowing them to design, create, manage, analyse and publish their own richly-structured database(s) within hours, through a simple web interface, without the need for programmers or consultants. (Sydney University, n.d.)

After some experimentation, we chose HEURIST for this project due to its ease-of-use. While we may be studying a subject that is steeped in code, we are certainly not experienced computer engineers or web developers (nor did we want to place that expectation on our collaborators!). It was necessary to find a database tool that would take care of most of the heavy lifting for us while providing a very shallow learning curve for additional participants. In a way, this embodies one of the key design sensibilities for GameSound: a desire to create an indispensable resource that, at the same time, is easily accessible for game scholars, ludomusicologists, and independent researchers.

In addition to the database itself, GameSound also exists as a web resource for those who are interested in ludomusicology and quantitative game analysis. The website currently hosts documentation outlining the project's methods and methodologies, and explains how many aspects of the research were conceived. Similar to how the database provides transparent access to videogame audio, we hope that the website provides insight into the various processes involved in our quantitative videogame analysis.

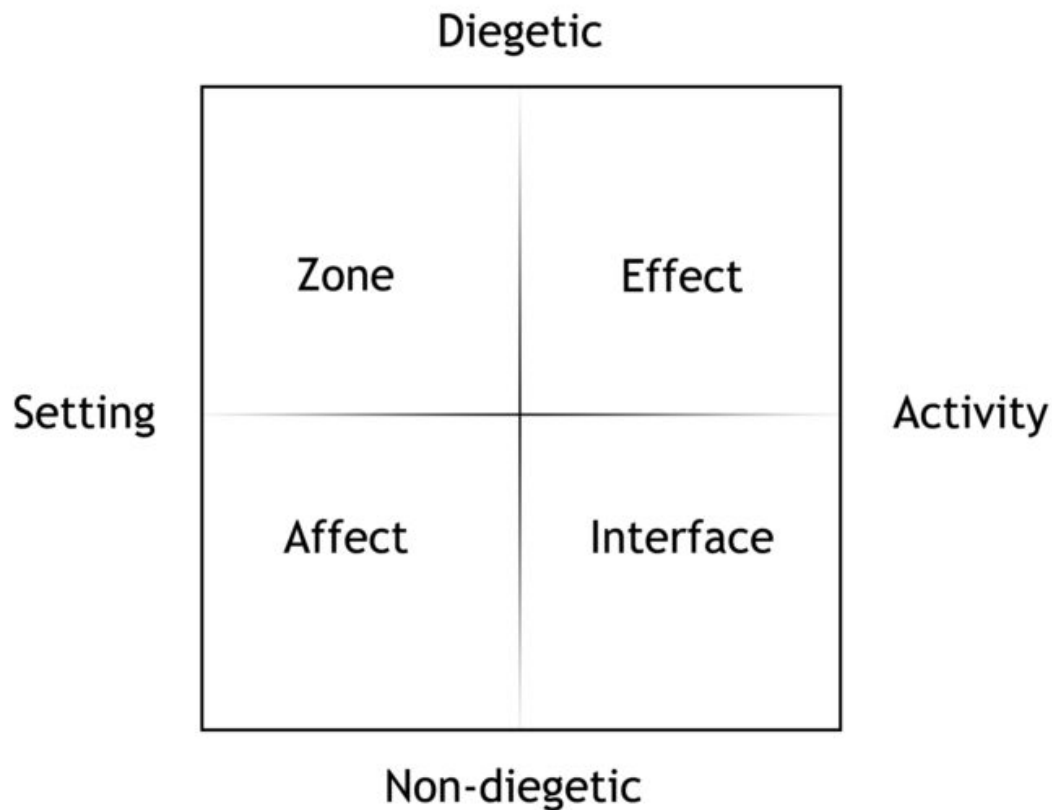
Challenges in Constructing the Database

Ludomusicology can be a complicated endeavour for researchers, scholars, and digital humanists. Much of a game's audio data is obfuscated through layers of code, file compression, and technical protection measures. Additionally, commercialized soundtracks and other releases of game music divorce audio content from its context within a game. As a result, conventional qualitative methodologies prevalent in ludomusicology, such as analytical play (Summers and Hannigan 2016, 52) and critical listening approaches, can lack the capacity to adequately investigate the layers of interactivity within the software that actually execute and manipulate sound. These layers "between the operations of a machine and the instructions given to it by an operator offer a fascinating archaeological study" (Burdick 2012, 53) as well as what we believe to be an intriguing way to analyze games. However, there is currently a notable lack of academic tools to enable this sort of quantitative analysis. Although some types of software exist to extract audio and game code, they generally fall into the realm of modding or hobbyism (Nosov 2017). Within the academic setting, there have been very scant efforts to formally seek out, sort through, and document these technical attributes - despite the possibilities that quantitative games analysis and, more broadly, ludomusicology provide for researchers.

Of course, with possibilities also come challenges. One of the biggest hurdles faced when designing GameSound's initial prototype was determining which of the seemingly endless data types we would consider worthy of inclusion in the database. As GameSound was not created with a specific research project in mind - focusing more on potential applications in the fields of musicology and game

studies - much of the initial data gathering was speculative. As a result, we opted to experiment with an extremely broad range of technical and musicological data. This, admittedly, may have led to some arbitrary decisions regarding data types, but also let us contemplate an enormous variety of potential applications for the database. Code snippets, screenshots, and even short videos were all considered during the prototyping process, before we whittled down the selection to its current state.

Although we were happy to experiment with most of the data types, one area of the database that we deferred to established scholars was that of ludomusicological classification. In an effort to place GameSound within current academic discourses, we decided to adopt the IEZA framework - a two dimensional method of describing sound in computer games. Designed by Sander Huiberts and Richard van Tol at the Utrecht School of the Arts, the IEZA framework provides ludologists with a customized vocabulary for audio classification.



IEZA Framework: Sanders Huibert and Richard van Tol.

The first dimension in the framework makes a distinction between audio originating from inside the fictional game world, such as the footsteps of a game character, and sound coming from outside the fictional game world, such as the title's musical score. The second dimension separates sounds related to the activity of the game (ones that result from direct player action) from sounds related to the setting of the game (ambient sound and music, for example). Four domains are formed across these two points of comparison: Interface, Effect, Zone and Affect (Huiberts and Van Tol 2008). When used in conjunction with the existing technical and descriptive categories found within the database, these domains allow users to quickly and purposefully explore videogame sounds using HEURIST's faceted search capabilities.

In addition to ludomusicological challenges and database design conundrums, Canadian copyright law poses two intriguing hurdles for GameSound. First, the music and sound effect files presented in the database are, naturally, the intellectual property of the original game developer and are used without explicit permission or licensing. Although there is a strong argument that GameSound's acquisition and use of these files falls under the educational aspects of fair dealing - "a user's right in copyright law permitting use of, or 'dealing' with, a copyright protected work without permission or payment of copyright royalties" (Simon Fraser University, n.d.) - copyright law is difficult for researchers to pin down and academic institutions are often wary of projects that challenge it. Despite its current availability as a public resource, access restrictions may need to be introduced as the database expands in order to mitigate legal risks or to appease university ethics departments. Secondly, the open file structures present in *Civilization IV* can be considered an outlier in a games industry that is constantly shifting toward tighter control of videogames and their assets. Publisher mandated terms-of-use and security measures, such as End User License Agreements and Digital Rights Management software, often create legal and technical barriers in accessing game data. This not only complicates the idea of fair dealing, but creates

additional challenges for the research team as they attempt to access and recover game assets that may be encrypted or hidden behind software restrictions.

Digital Humanities Case Studies

These types of restrictions and challenges may raise warning flags for scholars considering quantitative videogame analysis, but the research possibilities in both game studies and the digital humanities should not be overlooked. Instead of being afraid to interact with videogames, games scholars should be encouraged to adopt common digital humanities tools - such as search algorithms, digital archives, and data visualizations - and to poach approaches that have proven vital to established fields such as literature, history, and philosophy. The practice of isolating and extracting specific elements has enabled new types of distant reading in literature, for example, and many of the methods we use to analyze books can be co-opted for videogames and other digital media.

Jason Bradshaw brought this type of analysis to the forefront at the Congress of the Digital Humanities in 2018 with his presentation *BioShock Infinite and Feminist Theory: A Technical Approach*. Bradshaw collaborated with fan communities to acquire a complete written script (featuring nearly 250,000 words) from the videogame *BioShock: Infinite*, which then served as the corpus for his project. Influenced by a close reading of the game by Catlyn Origiano, who analysed the representation of female protagonist Elizabeth (Origiano 2015), Bradshaw wanted to demonstrate how distant reading could corroborate Origiano's qualitative analysis. He also had a strong desire to expand traditional distant readings of text to include videogames: "Why stop at the traditional textual mediums historically studied in the humanities? New types of digital analysis can also lend themselves to mediums born of the digital age" (Bradshaw 2018).

After acquiring the game's script, Bradshaw fed the entirety of the text into Voyant Tools - a popular piece of textual analysis software - to determine the frequency of certain words and where they occurred in the game's timeline. Bradshaw tracked how Elizabeth was referred to throughout the game as

well as how she was treated by other characters, resulting in a measured, textual character arc. By paying keen attention to labels such as “baby” or “child”, he analyzed her function in the storyline and how it could be “an allusion to the treatment of women in contemporary society” (Bradshaw 2018). Although by no means an authoritative take on the game’s narrative, the study demonstrates a progressive methodological approach for game studies: one that invites complementary quantitative analysis using methods generally reserved for literary works.

To compare and contrast, GameSound also takes a deconstructive approach albeit with vastly different subject matter. By putting an emphasis on searchability - and utilizing a variety of both technical and ludological descriptors - the database aims to facilitate access to a game’s audio elements without having to rely solely on playthroughs or fan-created resources. Much like Bradshaw’s work, once the heavy lifting of data input and formatting is complete, data analysis can be customized and executed rapidly. GameSound users have the freedom to tweak visualizations, create custom reports, and even embed content on the web for easy collaboration and knowledge dissemination. This approach allows for rapid oscillation between quantitative and qualitative methods, while creating a space for hybrid fields such as ludomusicology.

The [*LGBTQ Video Game Archive*](#) takes us beyond the purview of a single title, expanding the quantitative approach to include any videogame (from the 1980s onward) that includes LGBTQ content. An ongoing research project by Dr. Adrienne Shaw at Temple University, it presents itself as “a resource for researchers, journalists, critics, game designers/developers/publishers, students, gamers and/or people who play games and anyone else who is interested in learning more about the history of LGBTQ content in videogames” (Shaw, n.d). Although the project does not use what many would consider a traditional data-analysis tools - such as the aforementioned HEURIST or Voyant Tools - the website takes full advantage of its tagging capabilities. Users can easily sift through the archive by game series or publication date, and can filter through types of content such as “artifacts,” “homophobia/transphobia,”

and “relationships/romance/sex” by selecting sub-sections in the main menu (Shaw, n.d). The result is an easily navigable, fully public archive that includes text, images, and even video clips.

Much like GameSound, the archive blends qualitative categories alongside its quantitative elements to provide important contextual information. Although the main splash pages for each game tend to focus in what could be labeled as purely technical data - such as the year published, the country of origin, and the game’s box art - the “LGBTQ references” subsections adds a plain language summary of the reference in question. For example, in the *Rex Nebular And The Cosmic Gender Bender* archival entry, a hyperlink is provided to another page *Gender Swapping in Rex Nebular and the Cosmic Gender Bender* (Shaw, n.d.). This sub-section brings forth the broader reference category of “gender swapping” while documenting the presence of the trope by utilizing an approach akin to a gameplay log: a chronicling of the game featuring text, images, and even video clips (Consalvo and Dutton 2006). This brief but informative outline provides additional context that could not be gleaned strictly using quantitative data.

Visualizing the LGBTQ Video Game Archive, developed by Sofia “Milo” Utsch and Lu Braganca, builds upon the archive’s content by providing a more traditional “big data” outcome. Featuring colourful charts such as *Game Genre and Sexuality*, which illustrates Gay/Lesbian/Bisexual representation in games by genre, and *Types of Content*, which illustrates how entries within the archive are distributed throughout various categories, this type of visualization enables both the study of industry trends and various types of meta-analysis focused of the archive itself (Utsch and Braganca, n.d.). This broad overview helps establish the relevance of the archive, while also suggesting potential research outcomes and future applications.

In all of these aforementioned projects, we see the ways in which existing or emerging quantitative approaches can be used in the study of videogames. Whether presenting assets sourced from a “classic” videogame, enabling broad textual analysis of a specific character’s arc, or giving a broad

cultural perspective on many decades worth of titles, tools usually reserved for digital humanists or data scientists can be adopted to facilitate new types of scholarship. By reducing videogames to their component parts - sound, text, characters, etc - scholars can make them accessible for new types of research. This approach treats the game as a sort of text: one that can be examined using tools originally designed for literary works such as novels and manuscripts.

Conclusion

Keeping all of the potential of quantitative game analysis in mind, an obvious question for GameSound is: “what are the next steps for the project?” After receiving feedback on the working prototype from various game and digital humanities scholars, expanding the dataset to include additional videogames seems to be the obvious path forward. We are currently canvassing the game studies community to seek out collaborations with those who may find GameSound’s unique toolset useful for their own research projects. This expansion is important as, although the development process has been enlightening, a digital humanities project such as this cannot be truly evaluated until it has been put to use by a broad academic audience.

As with the prototype, any potential collaboration would revolve around a single videogame. Much like we did with *Civilization IV*, database updates will focus around the acquisition of audio assets from a game, followed by a sorting process (based around the researcher’s needs as well as the existing categories present in the database). This fresh infusion of data will offer new opportunities for introspection and revision, and the database may altered or completely rebuilt to include new categories, data types, or search functionality. Essentially, our goal would be to allow new collaborators to sift through the videogame of their choice with ease, allowing them to access the audio elements of a game without relying on repeated playthroughs or unreliable secondary sources. As with any addition to the database - which, barring copyright concerns, will always be publicly available - additional data will also provide scholars from all across the game studies and digital humanities communities with an opportunity

to reflect upon the technical parameters of game audio and to experiment with quantitative game analysis tools and applications.

GameSound is an iterative work. Beyond the research possibilities that it provides, it is meant to explore the ongoing technical challenges ludomusicologists face, such as data accessibility, copyright concerns, and the lack of established standards. Over time, we hope to collaborate with scholars across the world to expand both the scope and functionalities of the database, while constantly interrogating its efficacy as a research tool. Just as we hope to learn more about videogames by breaking them down into their component parts, we hope that by deconstructing and reconstructing our own work we can unearth valuable insights for scholars in game studies and the digital humanities.

Citations

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