




VM503
AESTHETICS AND HISTORY
OF NEW MEDIA

WEEK 11 CLASS 1

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Storage in Collaborative Networked Art

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Networked Music

- *Works in which artists consciously consider the topology, transmission, and storage mechanisms of a network, making **networks integral to the conception and realization of the work** - Jason Freeman*
- **Networked music can exist without technology:** broadly, *a network is a collection of interconnected people or things*; in a sense; almost any musical performance is networked: musicians transmit and receive visual and aural stimuli during the performance.
- Networks conjure the **transmission** of data. But, **storage**, **manipulation**, and **retrieval of data** are equally important components of network infrastructure and applications.

Storage

- How do networked participants -- trained musicians, casual users, or a combination of the two -- employ **storage as a medium for communication** and as a **means for collaboration**?
- How does the **design** and **implementation of storage** affect the nature of **collaborative creativity**?
- Telecommunications networks make **real-time data transmission** possible (collapsing our sense of space), yet **we often interact with stored data** (machines) rather than other people.

Internet Storage

- Computer networks have included storage as an integral component since their early development.
- The first version of the **FTP protocol**, a common standard for transmitting files across computer networks, was published in **1971**.
- Relational Software (now Oracle) released the first **SQL database** in **1979**.
- Tim Berners-Lee initially proposed the **World Wide Web** in **1989**, touting it as a **distributed, linked system** for **storing** information, notes, and documents and **connecting** multiple existing **databases**.

SQL is the new HTML - *Hal Varian, 2004*

- Computer networks are implemented through a combination of hardware and software.
- Network applications are able to take advantage of a wide variety of storage mechanisms, protocols, and structures, ranging from **simple file storage** (e.g. static web pages) to **structured databases** which can potentially be **queried, manipulated, updated, and expanded** by any person or device connected to the network.

Networked Music - Transmission Focused

- Facilitate **real-time communication among network nodes or participants.**
- Any *storage functionality* that exists is either **short-term** (e.g. buffering audio or video feeds to reduce dropouts) or **peripheral** (e.g. an archival recording used solely to document the work).
- Examples include **multi-location performances, telepresence environments, and web-based collaborative improvisations.**
- They **collapse geographic space; participation is synchronous.**

Networked Music - Storage Focused

- Storage-focused works would be difficult or **impossible to realize without a networked storage mechanism.**
- While they *typically transmit information across networks*, it is the **integration of a storage component** that distinguishes them.
- Examples include **social spaces**, and **collaborative tools**.
- They **collapse time**: participation can be **asynchronous**.



Rova Saxophone Quartet
*Maintaining The Web Under Less Than Obvious
Circumstances (1989)*

- The composition is the predetermined set of objects and hand signals, along with the formal protocol that defines the meaning of particular objects and gestures.
Composition is an act of network protocol design.
- “There are four **red flags** and seven **fans** as well as **hats**, **balls** and various other **hand signals** that are related to everything from speed and volume to the playing of harmonicas. *Any of the four musicians can give a cue at any time and dramatically alter the course of the piece.*”

Nick Collins / Click Nilson

- Information is exchanged via written instruction lists. Each instruction list becomes a storage mechanism on the network that can be preserved, modified, copied, and transmitted during the performance.
- *In Sand: Human Computation*: “[The] musicians, when not playing, had an active role in drawing out new instructions and modifying existing ones. I had a facilitation role, and wandered through the room helping to update papers and exchange them [between musicians].”
- Participants **change, add, delete, and copy** instructions. The **networked storage mechanism** enables the musicians to **continually recompose the score**.*

An Instructional Game for 1 to Many Musicians

Each performer maintains one or more lists of instructions: they begin with just the one below. Each minute, as reckoned by their poor sense of human long-term timing, they must follow one instruction per list in their possession.

1. (CHANGE) You may add a new instruction to your list or modify an existing one. 2. (DELETE) You may delete one instruction from your list. 3. (EXCHANGE) Exchange one instruction list with another player of your choice; they must defer but may choose which set to exchange with you if they have more than one. 4. (PROLIFERATE DUTIES) You may make a copy of an existing instruction set and henceforth proceed with this set too at the next calculation stage. 5. (SONIFICATION). During the next minute using your instrument or voice you may play the musical phrases embodied by instructions on one list in your possession. You will utilise timing, pitch and timbre as best you can to convey the spoken form of the instructions. 6. (TERMINATION). If you have four instruction sets or have exchanged four or more times you may finish playing the game.

Notes- modern versions of this game may find a photocopier or computer assistance helpful for copying and exchanging. It has also been found propitious to utilise projection of instruction sets to enable an audience to see the state of play- alternatively, the audience may wander amongst the performers and act as observers and arbiters of disputes.

Computer modeling of the game itself has been successfully demonstrated by some advanced performance groups.

Performers may wish to set a practical time limit too- rumour has it that Nilson is still playing after losing instructions 1 and 6.

Rova vs Collins

- Rova's musicians transmit **visual cues** to each other that are **perceived in nearly real time** and have an **immediate effect** on the cue's recipient(s). **Communication is largely event driven**; a cue may trigger a change in volume, a note cutoff, or a new imitative texture.
- Collins' musicians exchange **written instruction lists**; once received, musicians must take some **time to read and understand** the new instructions in front of them. The lists **remain in effect for extended periods** of time; as the performance continues to iterate, the lists **serve as the basis for future modifications and exchanges**.

The Hub

- “**The original computer network band**” (1989), it exemplifies the influence of technology on network design.
- Initially, participants **networked their computers** via a serial link **to a central computer** (also called “The Hub”) that **served as a shared memory** for the ensemble.*
- *Borrowing and Stealing* (1989): Because *the only way to communicate across the network* is to **share music** — not instructions or events — and because the only way to create music is to **draw from the material on the network**, the music exhibits a notable economy of means.

The Hub

- 1990: adopted a **MIDI** patchbay interface that enabled any member of the ensemble to send messages individually to any other member.
- In *Wheelies* (1992), players communicated not by sharing musical material with each other, but by **sharing control of their computers** with each other. Musicians send instructions that change parameters or trigger actions.
- The Hub's change in network technology prompted a shift **from a storage focus to a transmission focus** and **from a data-driven, shared material model to an event-driven, shared control model.**

Types of Storage

- Different kinds of networked storage mechanisms facilitate different kinds of artistic applications.
- A **flat-file** architecture encourages the **archiving and retrieval of discrete activities**.
- A **relational database** encourages the **structured, collaborative manipulation** and **retrieval** of data.
- **Some networked storage devices actively and autonomously transform the data themselves**; degrade or discard data over time; or iteratively mix or merge data elements.

Max Neuhaus

- Goal was to *combine the **public telephone network** and **radio broadcast** to make **a virtual aural space** in which a large number of people can be at the same time.*
- *Public Supply I (1966):* performed at WBAI radio in New York; no storage mechanism; sounds were manually mixed and broadcast over the radio as they came in over ten telephone lines; has an episodic feel to it as callers phone in, create their own distinctive layer in the mix, and then eventually disconnect.
- *Radio Net (1977):* 2-hour national broadcast event brought together 10,000 callers; asked to whistle, creating a more cohesive but less diverse timbral sound world; custom circuitry analyzed the pitch of each whistle to set its prominence in the mix.

From Latency to Persistency

- Time delays in real-time, synchronous, distributed, performances have required the development of storage mechanisms and even new musical styles to circumvent the effects of latency.
- Must participation still be simultaneous, or should each user individually manipulate the data store over the course of hours, weeks, or months?
- Is the data store a permanent entity that can be archived, retrieved, and shared, or does it exist only during a single performance event? Do participants focus more on the creation of a finished **product** or on the **process** of collaborative creation?

WebDrum vs Jamglue

- **WebDrum** focuses on simultaneous participation and on real-time experience of collaboration; makes no distinction between creation and performance or between process and product; when the last player leaves the jam room, the data is deleted from the server and cannot be accessed again; not popular, thus people often have no one to play with.
- **Jamglue** focuses on networked collaboration through a storage space shared over an extended period of time; interaction with networked storage is core to the user experience: participants consciously store their own mixes on the site and retrieve mixes and sounds stored by others.

Network Storage Design and Graph Theory

- On the Internet, interaction with stored data often takes place in the background; sometimes, we are not even aware it is happening.
- What level of awareness of networked storage is desirable for a work?
- How does that awareness affect the experience of the work?
- *Graph Theory* (2006) **de-emphasizes networked storage** in the main interface design to encourage participants to focus on their **individual experience** with the work.

Moment Form and Graph Theory

- Stockhausen's idea of moment form = **a collection of self-contained musical building blocks**: "... render every moment a Now ... are not beginning-middle-end forms ... the order of moments must appear to be arbitrary for the work to conform to the spirit of moment form." - Jonathan Kramer
- *Graph Theory's* individual musical fragments bear a strong resemblance to moments, and the multiplicity of possible arrangements of those fragments recalls moment form.
- It breaks from moment form in its insistence that **the order of its fragments does matter**: it is the primary creative activity of web site users. And while no single order is preferable, some are more effective than others, and each brings a different experience to hearing the piece.

Graph Theory

- Web site users engage with limited awareness of their collaborative role in the work.
- But for a specialized group of Graph Theory users — the violinists who perform the piece in concert — the role of networked storage moves to the core of their experience.
- Violinists visit the web site to print out the most recent version of the musical score, which is algorithmically generated on the server each day.
- Using the relative popularity of each navigation decision in the server's database, a variant on the traveling salesman algorithm* creates a version of the composition which favors the paths preferred by web site visitors.

Most Recent Score

The image displays a grid of 24 musical staves, arranged in 8 rows and 3 columns. Each staff shows a short musical phrase with a dynamic marking (p, mp, or pp) and a finger number (I, II, III, IV). Above each staff is a downward-pointing arrow and a multiplier (e.g., ~3x, ~2x, ~1x, ~5x). The staves are connected by vertical lines, suggesting a sequence of related musical ideas or techniques.

The database is written to store data automatically and **in the background**, while **the score is produced through the conscious action of a violinist**, who then must consider how to interpret the collective results of user activities and how to balance aspects of linearly-directed and moment form in their interpretation.

Bicycle Built for 2,000

- Also has two separate groups of participants, each with different levels of awareness of the networked storage mechanisms.
- 1. Participants have no awareness: via Mechanical Turk, 2,000 people listened to a short audio file and then recorded themselves imitating it; they neither had knowledge of the source nor the context; they were compensated financially.
- 2. Viewers have complete awareness; they visit the project web site where they can listen to the new version of “Daisy Bell”; and, via a visual score, aurally isolate individual contributions and compare them to the computer-generated recording.



Conclusion

Networked storage may be at the core of the design of a networked artwork, but that does not mean that it need be at the core of the experience of the work.