Studying the Conservation of Software-based Art: An interdisciplinary academic-museum research collaboration

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on exitframe
  if random(32)=1 then
    sound(5).volume = random(155)+100
    sound(5).play([#member: member("pop"), rateShift: ((random(20)+12))])
  end if

if the frame = marker("run") then doSound

on doSound
  IF soundON = 1 then
    repeat with x = 1 to 4
      if soundbusy(x) = false then

        cc = random(8)
        case cc of
          1: scaler = 0
          2: scaler = 2
          3: scaler = 0
          4: scaler = 5
          5: scaler = 7
          6: scaler = 9
          7: scaler = 10
          8: scaler = 12
        end case

        sound(x).play([#member: member(random(37,40)), rateShift: (scaler- ((random(3)+1)*12))])
      end if
    end repeat
  end if
The Conservation Object
The Conservation Object

Sun Yuan & Peng Yu, Can’t Help Myself (2016)
Conservation Issues
Conservation Issues

In the Guggenheim Collection:

- Missing back-ups
- Old and/or failing hardware
- Incomplete artwork description (collection database and object files)
- Incomplete artwork components (no source code, no media assets)
- Lack of understanding of artwork experience in native environment
- Lack of understanding of artwork behaviors and functions
- Lack of understanding of used software, hardware and programming languages
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In the Art Conservation Field:
- Lack of established back-up procedures (disk images, metadata)
- Lack of established documentation methods (artwork experience and source code analysis)
- Lack of best practices for acquisition
- Lack of conservation terminology
- Lack of computer science expertise
The CCBA Initiative
The CCBA Initiative

Goals
1. Preserve works in collection
2. Develop best practices for future acquisitions

Strategy
1. Comprehensive survey of all works
2. Back-up of all works
3. Identify treatment priorities
4. Case study research of selected works
5. R&D of new documentation methods

Project expertise and staffing
1. Research collaboration with NYU Computer Science (since 2014)
2. 2-year full-time Conservation fellowship position
1. Capturing the artwork experience
1. Capturing the artwork experience

Narrated screen navigation of Shu Lea Cheang’s *Brandon* (1998-1999)
2. Examination of native production environment

Projected Flash Animation

Analysis and documentation of the artwork in its native production environment Adobe Flash
2. Examination of native production environment
3. Source code analysis \(\rightarrow\) Conservation documentation

The Java program running on the computer establishes two channels of connection to the step motors using the USB-PIO cable. The cable is capable of making up to three channels and eight lines of connection per channel. Channel 1 is set up to be used by the program to output digital signals from the computer to the motors and channel 2 to gather input from the sensors attached to each of the motors. Channel 1 establishes six lines of connection, as shown in figure 2. Two lines of connection are necessary for the movement of each of the three motors. Pointer 0 and 1 are responsible for moving the motor attached to the second hand of the clock, pointer 2 and 3 for the minute hand of the clock and pointer 4 and 5 for the hour hand of the clock.
4. Conservation treatment and accessibility

- disc imaging and back-up
- creation and testing of replica computers
- emulation testing
- migration prototyping, here Java to javascript
Academic Requirements

Recruitment

- Students receive academic credit for research projects
- Students are carefully selected among a pool of applicants
Writing Experience

Students write reports to capture research results:
• Documentation, including Conservation templates
• Spreadsheets to capture tabular data
• Charts and flowcharts
• ... and other formats.
Public Speaking

Case study presentations in the media conservation lab are open to Guggenheim staff and their guests.

• Students do oral presentations at the end of each semester.
• For many students: first public speaking experience
Academic Requirements

Weekly meetings with faculty member or mentor:
• Students meet weekly with a faculty member or mentor
• Variety of research approaches and methodologies
• Joanna and I role-model inter-disciplinary collaboration
The great variety of works in Guggenheim collection offers wonderful pedagogical challenges:

- Range of historic and contemporary production environments includes Adobe Flash, Macromedia Director etc.
- Range of historic and contemporary programming languages includes Lingo, PBASIC, Java, SP-Forth, Javascript, PERL etc.
- Range of hardware and software dependencies
- Technology levels are typically appropriate to advanced undergraduate Computer Science majors
Reverse engineering:

- “Reverse engineering” is one approach in Computer Science pedagogy.
- Many of these projects require reverse engineering as part of the research.
Computer Science Pedagogy

Hands-on Experience:

• We have been fortunate to obtain old equipment from the Courant Systems Group.
• Students learn to set up and monitor their test environment for the software as part of their research.
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Research and Intern Experience:
- Students have the opportunity to do original research and get experience in a “real-world” working environment.
Research Approach

The Source code:

• Guggenheim supplies NYU faculty and students with artwork source code
• If source code is not available, students learn how to decompile executable file
Source code analysis and documentation. Students are...

- writing high-level descriptions of specific aspects of program
- annotating the source code itself
- creating lists and spreadsheets to identify functions, variables, files and other components of the work.
Research Approach

Studying the native environment

- Understanding artist’s creation process and use of software
- Documenting artist’s decision making
Research Approach

Artist Interviews: Students participate in artist interviews by ...

• Composing questions for the artist in discussion with Joanna
• Participating in the artist interview
• Accommodation of artist’s statements in risk assessment
Research Approach

Conservation templates

- Completing Guggenheim conservation templates as students write up their findings, including artwork's hardware and software components
- Feedback round with Joanna
Guggenheim-NYU Research Approach

**Documenting conservation risks**

Students identify and document conservation risks by:

- Listing hardware and software dependencies
- Identifying software libraries that might no longer be available
- Pointing out specific technologies which pose risk
- Identifying fragile hardware
- Identifying possibly unnecessary complexities (such as a server-side relational database when a simple text file might suffice)
- Identifying damages, such as broken links etc.

Net.flag is created as Java applets run in a web browser, utilizing Perl to manipulate its datafile. Net.flag is composed of HTML code and can be viewed in a web browser. The source file contains .class files as well as Perl scripts. Net.flag could be accessed via the internet. It can also be a static gallery installation, with a desktop allowing users to interact with it. Previous curators had net.flag presented as a slide-show as well.

One of the many important Net.flag features is interactivity. It allows multiple users to interact with the applet and see their individual works (or "flags"). The user works with a mouse to click and drag flag elements. Users are prompted to enter "title" and "comment" during saving, but input is not required. Computers need to be connected to the internet to load the applets. Java Runtime Environment (JRE) needs to be installed and modifications to the Java configuration for security reason are required to run the piece. Every user will get the exact same applet every time they reload it. One note: the latest version of chrome no longer support Java applets.

The following paragraph is included in the web description: Net.flag explores territorial identity by turning the visual language of international flags into a tool for individual expression. Through an online software interface, visitors from around the world contribute to one "flag for the Internet". The visitor to net.flag not only views the flag but can change it in a moment to reflect their own nationalist, political, apolitical or territorial agenda. The resulting flag is both an emblem and a micro territory in its own right; a place for confrontation, assertion, communication and play.
**Guggenheim-NYU Research Approach**

*Conservation treatment*
Building prototypes for conservation intervention, by...

- Writing software to render the artwork and allow it to run.
- Setting up test environments to test an approach such as emulation for a specific work.

**Before:** (w/o java applet exception)

**After:** (w/ java applet exception)

**Migration from Java to javascript, Shu Lea Cheang’s *Brandon* (1998-1999)**
Research Presentation and Discussion: Students give a formal presentation to Guggenheim staff and the NYC conservation community.
Thank you!

Solomon R. Guggenheim Museum

Brian Castriota, former Samuel H. Kress Fellow in Time-based Media Conservation
Amy Brost, former Andrew W. Mellon Graduate Intern for Time-based Media Conservation
Lia Kramer, former Polonsky Intern for Digital Humanities
Jiwon Shin, former summer intern for Time-based Media Conservation

New York University

Fall Semester 2014
Jiwon Shin
Aarti Chandrakant Bagul
Shan Shao

Spring Semester 2015
Jiwon Shin
Michelle Liu
Vivian Peng
Emily Hua
Caroline Slason
Mia Matthias

Fall Semester 2015
Emma Dickson
Jillian Zhong

Spring Semester 2016
Emma Dickson
Jillian Zhong
Kaitlin Gu