RICE UNIVERSITY

We Are Nowhere
An Interactive Work for Music | Dance | Film

By

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ABSTRACT

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Acknowledging technology’s impact on the ease and precision with which we capture moments of our daily lives, We Are Nowhere engages questions of memory and identity and investigates what is lost and gained through the streamlined manner in which we are able to create synthetic memories.

To foster an environment for fluid exploration of these ideas, the piece employs interactive elements such as motion tracking and gesture recognition of the dancer, and digitally interfaced technology of the past—including 8mm film projectors and analog typewriters. All of these interactive elements inform and control the manner in which the music and film is realized.
We Are Nowhere

Our present state is associated with other states that, rejected and localized in the past, constitute our person such as it appears at each instant... It would seem, according to this account, that the identity of the self rests entirely on memory.  

Théodule Ribot

Memory is a construct that informs our daily experience. The degree to which we retain or forget our past influences the perspective we bring to the present. Memory focuses the limits of our perception and places boundaries on what we can and cannot comprehend. Indeed, a “healthy” memory is a "balanced" memory—where just enough is retained and just enough lost. In other words, “normality depends on conservation without an excess of reproduction”.

Today we find ourselves at an increasingly strange juncture. With the continued advancement of digital & social media, much that would normally escape our memory is preserved in remarkable fashion. Our past experiences float around us in a cloud of high-definition images, readily accessible from any point around the globe. It is entirely feasible that individuals born today will have nearly every day of their lives documented and preserved in digital formats. The mundane and monumental will be captured with equal precision, stored in clouds and hard-drives and recalled at any given moment.

We are, in a sense, creating synthetic memories—memories constructed from third-person images that faithfully render the captured experience. But for all of their precise imagery, synthetic memory does lack other sensory information that we automatically capture with our first-person natural memory. The smell, taste, touch, and (often) sound of an experience has yet to be included in third-person renderings of experience. Natural memory also holds the monopoly on omniscient perspective—high-definition digital media is unable to convey the thoughts of the individuals it represents...for now.

These synthetic memories raise two important questions:

1. How is our construct of identity—a manifestation of memory and experience—effected as the scale of our “healthy” and “balanced” memory tips to the side of conservation?
2. What is lost or gained when our first-person memory is augmented or altogether replaced by third-person synthetic memory?

We Are Nowhere engages these questions through the lens of interactive music, dance and film. The piece (ranging 15-20 minutes) is set in three distinct areas and allows a dancer to move fluidly and spontaneously throughout the space, traversing each area as musical elements track and respond to her motion. The entirety of the musical elements (including electronic manipulations) stems from a library of music composed for cello and recorded in advance. When performed, the sound is spatialized through live diffusion—a process in which individual streams of sound are routed to different speakers in real-time at a mixing board. This process occurs during the actual performance and is not preset.

Within each area the dancer is surrounded by synthetic memories of her childhood—specifically, video footage of her 4 year-old self on Easter Sunday. Different scenes from the footage inhabit different sections of the space. Within these sections are memory-charged objects such as toys from her childhood, family member possessions, and empty picture frames that seemingly need filling.

Interacting with these physical objects and the synthetic memories, the dancer explores the conflict between the desire to recreate the sensations of her natural memory and the more idle experience of seeing her past through third-person perspective.

1 Théodule Ribot, Maladies de la mémoire (83)
2 Michael S. Roth, Memory, Trauma, and History (13)
We Are Nowhere (cont.)

At the center of the three areas is the memory vortex. Here, a typewriter sits ready to give the dancer (and audience) what the synthetic memories cannot: omniscient perspective. As the dancer moves between areas she is able to give voice to the sensations that only she can know. What did Easter in 1988 feel like to her? What could she smell and hear and taste? What was she thinking?

Within this exploration of synthetic and natural memory, interactive media is implemented to reflect the fluidity of the unfolding events. Throughout the work, motion tracking is utilized to follow the dancer as she moves to, from, and within each area. The data collected from her movement is then interpreted and realized in the musical output. How the dancer moves, where she moves to, and specific gestures all inform the content of the music and the manner in which it is played. Additionally, the data from the moving dancer impacts the playback of the 8mm film projector.

The aesthetic choice to utilize analog technology—8mm film, typewriter—accomplishes two goals. First, it draws attention to the odd phenomenon of seeing images of one’s self from the past. The streamlined nature of today’s technology makes it easy to take for granted the relatively new concept of capturing our past in images. The lack of subtlety in analog technology—popping, clicking, buzzing, etc.—keeps us aware of this phenomenon throughout the piece. Second, analog technology renders the interactive mechanisms of the piece transparent. The audience is able to more clearly see the way in which the music, film, and dancer interact because the response is occurring in physical objects rather than internal digital processes. Indeed, the tactile nature of the analog technology aids in the construction of a “live counterpoint” as the technology is an active and visible part of each area.

In We Are Nowhere, interactive music and technology are utilized in a performative manner but their implications reach much further. In the field of music there has long been a concern for getting more seats filled in the concert hall. More recently this dialogue has shifted focus towards new ways of getting the music out of the concert hall. Today music is a far less social medium than it once was. Often, people’s experience of music only occurs in solitude through ear buds or car speakers as they commute to work or sit in an office.

The interactive relationships presented in We Are Nowhere offer a new way to get music out into people’s lives. As demonstrated, composers can create libraries of music that respond to stimuli from the listener. With a growing number of devices equipped with Wireless Internet, Bluetooth, and GPS capabilities, much of the requisite technology is already in place. Music could be downloaded to smart phones and tablets and score an individual’s life as they move about a city, matching tempo with pace, content with location and counterpoint with environmental interaction. Perhaps this is just the interaction needed to inspire individuals to once again make their way to the concert hall…never leaving the music behind.

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3 See Interactive Components for a complete description of the relationship between music, movement, and film.
the piece begins with the dancer entering the space and ends when she leaves

Area Diagram

1 - empty picture frames
2 - typewriter
3 - past possessions
4 - projectors (x3)
5 - speakers (quadraphonic)
6 - basket
## Interactive Components

### Area I

**Input from Dancer**

- **Movement** (outside projection path)
  - M1, M2, Ripple 1**
  - Audio from source footage (digitized from analog format to allow for electronic manipulation)
- **Engaging with picture frame**
  - M1, M2, Audio from source footage
- **Crossing projector path plane**
  - Live Convolution**

**Musical Elements**

- Interchangeable Counterpoint - musical elements are dynamically recombined to create a continuously shifting stream of counterpoint
- Snapshot Playback - interactions between individuals in the filmed scenes are isolated and reproduced in short segments
- Live Convolution** - convolution of elements in real-time, creating ghostly, ethereal versions of their original forms (in this instance, playback speed is at 100%)

**Electronic Elements & Manipulation**

- **Velocity Controlled Density** - contrapuntal layers emerge and disappear as the dancer’s velocity increases and decreases respectively
- **Gestural Cuing** - the act of selecting a picture frame from the floor is registered and triggers the snapshot playback
- **Gestural Cueing** - live convolution is triggered as the dancer’s body crosses the plane of the projection

**Method of Interaction**

- **Presence Detection** - live convolution of L1/L2 occurs when the dancer’s presence is detected in this scene
- **Gestural Cuing** - live convolution of soundtrack audio occurs when the dancer sits down to type

**Typing (2)**

- Vortex Playback - selections from the three musical elements are independently triggered and continually varied in terms of the specific selection and its direction of playback
- Keystroke Triggering** - V1,V2,V3 elements are triggered at varying intervals (i.e. after 10 keystrokes, then after 5 keystrokes, etc.)
- Keystroke Triggering** - variable playback speed is activated with an initial keystroke and returns to a default 75% playback speed after a 3 second lapse in typing

**Typing (1)**

- Vortex Playback - selections from the three musical elements are independently triggered and continually varied in terms of the specific selection and its direction of playback
- Keystroke Triggering** - V1,V2,V3 elements are triggered at varying intervals (i.e. after 10 keystrokes, then after 5 keystrokes, etc.)

**Area II**

- **Movement**
  - L1, L2
- **Sitting down to type**
  - Audio from source footage (digitized from analog format to allow for electronic manipulation)
- **Typing (1)**
  - V1,V2,V3
- **Typing (2)**
  - Convolution of L1/L2

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****see technical descriptions at end of score
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**see technical descriptions at end of score**
M1 (cont.)
M1 (cont.)
M1 (cont.)
M2 (cont.)
M2 (cont.)
L1 (cont.)
**Live Convolution**

Convolution is an integral that communicates the amount of ‘overlap’ between two functions and is represented mathematically by this equation (for functions $f$ and $g$):

$$ f \ast g(t) = \int_{x=0}^{t} f(x)g(t-x) \, dx $$

In musical and audio signal processing terms, convolution allows us to fold two audio signals upon one another. This is akin to the result one might get from smearing two colors of paint together on a canvas—both source colors are perceptible, but a new and modified color has emerged.

In *We Are Nowhere* convolution is used to blend musical elements. Pictured here are two renderings of waveforms that correspond to a selection from M1 and M2. The third waveform rendering displays the result of convolving these two elements.

Due to the interactive nature of *We Are Nowhere*, I’ve programmed the convolution apparatus to allow for “real-time” implementation. That is, at any given moment the dancer is able to trigger the apparatus to select two sources, convolve those sources, and play the resulting sound back instantaneously.

This real-time implementation allows for many interesting musical possibilities, such as convolving two sounds that were just heard in “traditional” counterpoint and hearing the “convolution” counterpoint in response.
**Ripples**

*Ripples*, a term specific to this work, are created by isolating the highest partials of an audio event and exporting them as a new and distinct sound file. In *We Are Nowhere*, this process is applied to M & L elements and their post-convolution forms.

The *ripples* serve two main purposes. First, they lend a degree of articulation to the dancer’s motion. Similar to ripples in a body of water, the dancer’s movements “disturb” the air around her. The ethereal nature of these high partials evokes a kind of sonic ripple that is created as the dancer moves through the space. Second, these partials, being members of the overtone series, produce pitches outside of the M & L sets and serve as contrasting elements.

*ripple effect applied to convolved form of M1 & M2*
Variable Film Speed

Interfacing the 8mm film projectors to the motion tracking mechanism requires both digital and mechanical manipulation. To obtain fluid control over the gears that power the projector, the built-in AC motor is bypassed in favor of a unipolar stepper motor which is retrofitted to the body of the projector. Once in place, extremely precise dictation of speed and direction is possible.

Digital manipulation is then required to link the stepper motor (powered by an Arduino micro controller) to the dancer’s movements which are being tracked by a Microsoft Kinect motion-tracking sensor using code developed in the open source programming software Processing. The link is created through communication between the Processing code and the Arduino code by way of the serial port. As the Processing code runs, it collects 3D coordinates of the dancer’s body and computes her velocity in real-time. This value is received by the Arduino where it is mapped to a value between 0-200 that corresponds to the speed of the stepper motor.
**Keystroke Triggering**

In *We Are Nowhere*, the typewriter becomes an interface for musical creation. Integrating the analog typewriter into the digital sphere is accomplished by way of impact sensors at the base of the letter keys. With each keystroke, a signal is sent to an input on an Arduino microcontroller which is then converted into a digital message and triggers the appropriate alphanumeric character to be projected.

This interface allows the dancer to control several aspects of the music that surrounds her. As she types, her key strokes are registered in an apparatus that will then trigger sound files from the *Memory Vortex*. However, by design, the relationship is not direct—that is, not every keystroke triggers a sound. The keystrokes are counted and trigger at randomized intervals ranging from 1-15 keystrokes. Once the specified interval is reached—and a sound is triggered—the interval is reset to a new value between 1-15. The apparatus contains three of these interval triggers which, combined, realize the swirling, unpredictable nature of the Memory Vortex.

The interfaced typewriter impacts another element of the music: playback speed. Keystrokes are sampled and compared against a metronome running at 60bpm to record the dancer's letters-per-second ratio. This ratio is then scaled to produce a value between 0.25-1 and is used to determine the playback speed of the background musical layer—where 1 is 100% playback speed.
Cello Samples (M, L, and Memory Vortex Elements)

The music that serves as source material for the entire piece derives from two pitch sets and creates the two musical elements M and L:

M  [ 1, 2, 4, 6, 7, 9, 11 ]
L  [ 0, 2, 4, 5, 7, 9, 10 ]

["fixed" 0 (C natural)]

While it is possible to label these sets as D ionian and D aeolian, this interpretation is not particularly helpful. The internal cadences and agogic accents within the M and L elements are continuously shifting. This helps to emphasize the characteristic interchangeable counterpoint at the center of We Are Nowhere. The tonal centers, like the counterpoint, are continuously changing as the dancer moves throughout the space rendering these sets in a pan-diatonic manner.

The dichotomy that is created between the two sets emphasizes another important aspect of the piece: the conflict between natural and synthetic memory. Utilizing two clearly distinct sets lends a degree of aural transparency to the music which in turn allows the listener to create associations with each set—associations such as specific areas or types of movement. The transparency of each individual set allows the mixtures of sets to also be transparent.

The Memory Vortex is an important example of the blended set. Within the vortex (which constitutes Area II) the dancer is typing thoughts that derive from her natural memory. These thoughts, projected along side images from synthetic memories, create a juxtaposition that is mirrored by the music as pitches from both sets are triggered at unpredictable, swirling intervals (see keyboard triggering). As part of this swirling texture, Memory Vortex elements are, at times, played in reverse. This feature accounts for the ultra-specific endings of each pitch. When playback is forward, these pitches occur on the beat (of the 60bpm click). When playback is reversed, these pitches will occur off the beat due to the rests at the end of each pitch. The unique formatting used in the notation of Memory Vortex I and II is meant to reflect the swirling nature of the music when it is realized.

It is also important to note that neither the M, L, nor Memory Vortex materials have notated dynamics. This is due to the nature of live diffusion (see page 1). Throughout the piece, the volume of the materials will be part of the spatialization process as the sounds are directed to the quadraphonic outputs.
Notes

*We Are Nowhere* is a collaboration between Mark Hirsch and Lydia Hance (Executive & Artistic Director of Frame Dance Productions)

Additional technical support from Mike Beradino & Dr. Kurt Stallmann

8mm film processed by Spectra Film & Video (North Hollywood, CA)

Links to Processing & Arduino codes and Max/MSP patch are available at www.mhinterarts.com/private

www.mhinterarts.com

www.framedance.org