Neil and Iona: A Case Study in Cybernetic Performance Art

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Abstract

In the course of developing technology to make artworks improvisationally simulate emotional behavior in real time and space a boundary was crossed between the disciplines of static sculpture and live performance. This paper documents the basis of the Smile Project's creation, the resulting new technology and the questions that have arisen for the artist in his pursuit of the project's creation.

Keywords

Behavior
Cybernetics
Interactive
Multimedia Performance Art
Psychology
Robotics
Sculpture
Software

Biographies

Jason Van Anden's cybernetic artworks have evolved through a mix of passionate art making and a compulsion to invent. His current focus is on developing graphical software-based systems that simulate human emotional interaction based upon what he perceives as behavioral mechanics. This investigation has resulted in a variety of artworks, including a pair of human scale emotive robots named Neil and Iona, and a popular online videogame called Farklempt!. Van Anden holds a BFA in Sculpture from Syracuse University and attended the Skowhegan School of Painting and Sculpture. He is the President and Chief Executive Officer of Quadrant 2, Inc., a technology company he founded in 1996.

Lauri Goldkind is a PhD candidate in Social Work at the Wurzweiler School of Social Work at Yeshiva University in New York, NY and holds a Masters in Social Work from the State University of New York at Stony Brook, Stony Brook, NY. Her dissertation focuses on the intersection of the juvenile justice and public education systems. She has raised money and run programs for a variety of nonprofit agencies in New York City.

Introduction

Neil and Iona (fig. 1) are a pair of human scale robotic sculptures who interact with each other and their audience "emotionally". Each is capable of manipulating the other's feelings, as well as those of their audience, through facial expressions, sound and movement.

Fig.1 Three views of Neil and Iona moving in real time demonstrating a variety of different gestures.

In the course of their creation a line was crossed between sculpture and performance. What I originally understood to be an ensemble of sculptures had become an infinite series of performance pieces differentiated by the material they were provided. I am still grappling with the challenges this paradigm shift has produced.

New media technologies have made it very easy for artists to mix disciplines once separated by well-developed boundaries. This article discusses the concepts that inspired the creation of Neil and Iona, documents the technologies designed to realize them, and presents questions raised by their exhibition.

Concept

I am sculptor and professional software architect. The creation of living artworks has been an opportunity to mix two areas of my passion and expertise. The idea was sparked by something that I most likely misunderstood while listening to a radio interview. What I thought the guest had explained was "how our first understanding of love comes from recognizing our mother's smile..". I have since been corrected, but this snippet of cognitive science inspired a lasting interest in the emotional exchanges between people. In 1998, I started to create a series of primitive drawings representing visual/emotional connections as seen from an infant's vantage.

At the same time I was also attending weekly group therapy sessions. In therapy I started to interpret the repeated patterns of behavior taking place between my fellow participants and I as feedback loops. Feedback loops are a central idea across many disciplines. F. Heylighen, C. Joslyn and V. Turchin (2005) define feedback loops as the flow of information back to its origin

in a system. Further, a feedback loop is a circular causal process in which information leaving a system is returned as inputs to the system possibly involving other systems in the loop.

An example of how a feedback loop might impact a group therapy session follows: Participant A brings up a problem that everyone but Participant B can relate to. As the rest of the group engages in a discussion about A's problem, B begins to feel bored. B's boredom mounts and turns to frustration and anger. B's anger builds until it takes the form of an outburst and B blames the group for being insensitive. The discussion turns to focus on B, which makes A feel start to feel disenfranchised, and disconnected, which soon mounts to frustration and anger, and so on.

I was very interested in what such a system might look like visually, and developed software later in 1998 to represent this. This software took the form of a group of simultaneously running applications that could pass data representing human interaction between themselves. Upon receiving data, each would play out a behavior and then broadcast feedback to the other participating applications. The behavior and the feedback were determined by unique properties assigned to each application.

More recently in 2004, in conversations with artist and California University, Sacramento mathematics professor Gene Oldfield, I came to understand my software as a sort of finite state machine. Kam (1997) describes finite state machines as models of behaviour composed of states, transitions and actions. A state stores information about the past, it reflects the input changes from the system start to the present moment. Transitions indicate that a state has changed and are described by conditions that would need to be fulfilled to enable the transition. An action is a description of an activity that is to be performed at a given moment (Kam, 1997).

Oldfield also suggested I investigate Cybernetics, a discipline that has been overshadowed by modes of science, but sought to blend epistomology, scienentific method and systems theory. Wiener (1948), a founding father of Cybernetics described it as: the study of control and communication in the animal and the machine. Werner and his contemporary Ludwig Bertalanffy a founder of Systems Theory, were interested in how feedback acts to regulate a system and saw the mechanism of feedback as a universal construct affecting all systems including those electronic, mechanical and emotional (Scrivener, 2005). While both Cybernetics and Systems Theories are not at the forefront of theoretical thinking in the sciences today, they are precursors to more modern communications theory, information systems theory and computer science.

Although not its original intent, the desire to debug my group therapy experience had led me to create a finite state machine in the spirit of Cybernetics. I merged this technology with art, animating my primitive mouth drawings as a way to express how the program was feeling. This evolved into "The Smile Project", an installation of a family of five interactive human scale robotic sculptures, each with its own personality, capable of emoting using sound, body language and facial expressions.

Neil and Iona [fig 1] were created in 2003. They are the first two of the family of the five animatronic sculptures that were originally envisioned. In the course of their development, it was vitally important to me that the viewer's aesthetic experience transcended the technologies driving them. I did not want the "gee-wiz factor" to overshadow the art. Their facial expressions are comprised of hundreds of animation cells drawn in graphite on Mylar and their fleshy bulbous bodies are carefully sculpted objects. I set a goal that they be visually compelling with or without electricity. By adding sound and gesture, I came to realize that I had crossed a boundary into performance. With this in mind, I refined my software to be based a loose understanding of modern improvisational performance.

Software (TheEgo)

The brains and spirit of Neil and Iona are a software package I invented called TheEgo. Referencing one of the most seminal psychoanalysts of the twentieth century, Sigmund Freud (1856-1939), TheEgo is a technological representation of my understanding of human personality and interaction. Heffner (2005) explains Freud's theory of personality development and his notion of the ego as the reality based part of one's personality that moderates between one's impulses (the Id) and one's moral compass (the Super-Ego). TheEgo software is a personality model that takes into account the feelings of robotic others.

Version 1.0 was written in Visual Basic 5.0 in 1999 and ran on a network of five and used 486 computers running Windows 95. Each computer used sounds and animated facial expressions to express itself. The current version, TheEgo 2.0, uses the same architecture as version 1.0, with enhancements that enable motion control, input for sensors, and a sophisticated graphical interface used to design personalities. This was written in Python 2.3, and is run on embedded systems inside each robot, currently Gentoo Linux. Each uses a CMUCam for vision, and ControlFreak stepper motor controllers for movement and gesture.

TheEgo has two modes of operation, a runtime mode called Egotronic and a design mode called Super-Egotronic.

Egotronic

Egotronic mode is run during exhibition. In this mode, the software decides how to act based upon a personality file defined in Super-Egotronic mode. The flow is straightforward; the robot receives input, chooses a behavior and then commands the appropriate devices accordingly whereupon it loops back.

The input takes two forms, sensory and emotional. Sensory feedback is received by hardware connected to the robot itself, currently the CMUCam and feedback from the ControlFreaks. Emotional feedback comes from data packets passed between robots that describes its current state of mind.

The output of Egotronic mode comes in the form of the physical movement of the robot, the sounds it makes and the facial expressions output to the screen. Super-Egotronic can graphically simulate what will occur in Egotronic mode; therefore it is the best way to illustrate the output of Egotronic mode.

Super-Egotronic

Super-Egotronic mode is used to build sequences of activity called Behaviors that are assembled to create a robot's Personality. The interface is broken into three sections, the Unconscious, the Imaginary Order and the Mood Grid (fig. 2).

Behaviors are made up of a series of elements called "beats". Each beat represents a moment in time, like a drum beat. Each beat defines actions that should take place when its turn comes up. These actions can take the form of an image, a sound, or a command that describes how the robot's body should move or a combination of all three. A behavior requires at least one beat that is followed by as many as is needed; the number of beats determines the length of the behavior.

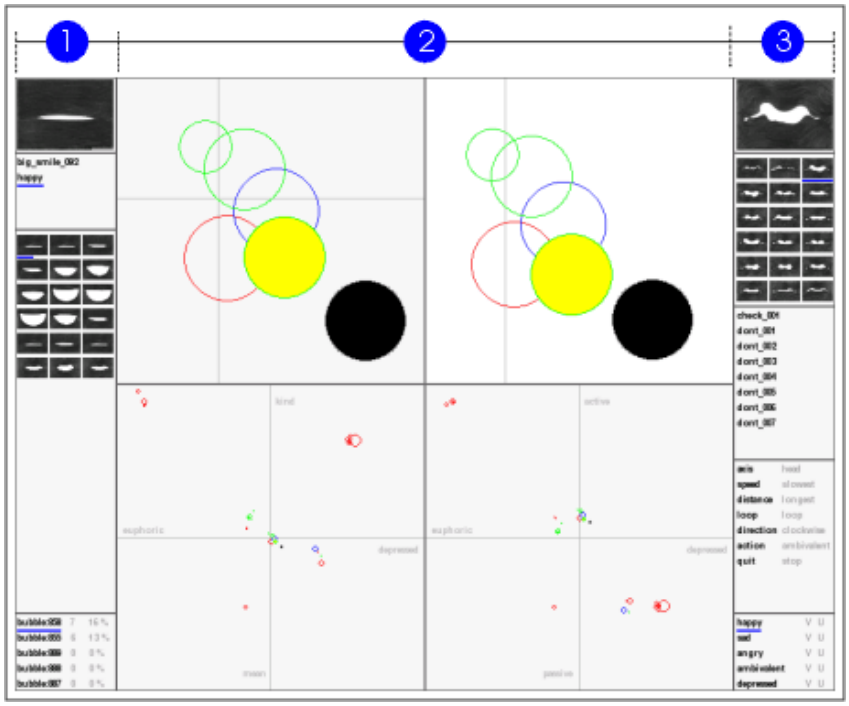

Fig.2 TheEgo Software(screen capture)

1. Conscious:	Used to assemble sequences of activity that form a behavior.
2. Mood Grid:	Three-Dimensional universe where behavior bubbles are plotted to form a personality.
3. Subconscious:	Palettes or repositories of images, sounds and movement commands used to define a behavior.

Each behavior is assembled in the Conscious, the pane of the software (see figure 1.) that serves as a workbench for creating behaviors. Freud believed that everything one is aware of is stored in the conscious, and this pane acts as the small portion of the software that forms behaviors. Freud also described the concept Subconscious, or the part of one's personality that is right below the surface of our everyday interactions. For TheEgo, stockpiles of information such as images, sounds and commands are stored in the Subconscious (Heffner, 2005).

A Behavior is plotted in a multi-dimensional universe called the Mood Grid (fig. 3). The Mood Grid looks and functions like a vector based 3D drawing program, the behaviors appear as colored circles on it. Like in a drawing program, Behaviors can be inserted, moved, sized and deleted. Behaviors can also be grouped together, moved as a unit, and assigned to a layer that can be colored, locked or made invisible. Each view can be zoomed into or out of and scrolled. The user can choose to see four views at a time, or one large view. The user assigns which 2D plane is displayed in which window. The Mood Grid can be configured to use as many dimensions as is imagined, however I find working in more than three becomes really hard to comprehend.

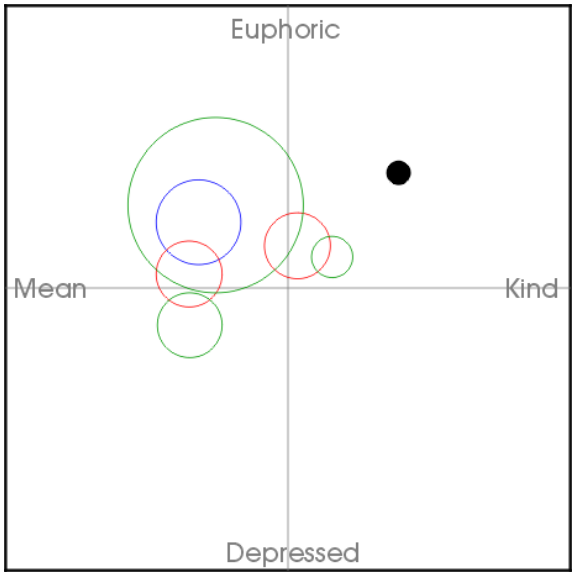

Fig.3 Mood Grid (screen capture)

The user can also configure the names of the axes. I work in three-dimensions labeled as:

- Euphoric - Depressed
- Kind - Mean
- Active – Passive

Personality development flow:

1. A new Behavior is created and appears both as a circle on the Mood Grid and as a new sequence in the Imaginary Order.

2. Sequences of images, sounds and movement commands from the Unconscious are assembled into a behavior in the Imaginary Order.

3. Behaviors bubbles are arranged in the Mood Grid to define complex probabilistic behavior.

4. A simulation is run, and the results are reported in the Crystal Ball.

5. The personality file is saved, uploaded to the robot and run in Egotronic mode.

Behavioral Development

The uninterrupted sequences of Behaviors are probabilistically determined by their placement in the Mood Grid, weighted by feedback represented by objects called Influence Points. The rules are pretty simple; a Behavior can only transition to another that overlaps it. The amount of the area of intersection, and the current behavior's proximity to Influence Points determines the likelihood of it being chosen during a turn. Influence Points represent feedback activity such as sensors and the emotional state of the other entities, depending on how close they are to the current Behavior determines the strength of its pull. Super-Egotronic mode can run as a graphical simulation that reports the traversal ratios over time. This feature can be very useful in understanding how a system works, and is relied on to fine tune the Personalities.

Identity Crisis

Historically, there is a prerequisite period of creative confusion artists must endure if a new medium is to ripen into a new art form. Daniel Giordan describes this phenomenon in terms of how photography impacted painting:

> "Empowered with the ability to authentically capture images in a split second, the photographer became the official recorder of our life and times, a role that painting had held for hundreds of years. In 1839, faced with the invention of photography, Paul DeLaroche is supposed to have declared, "From today, painting is dead." Painting was not dead, it simply needed to assume a new role regarding the kind of art it would create." (Giordan, 2005).

I believe that it would be naïve of me to assert that emotive cybernetic improvisational performance will one day justify its own genre. Artists working with simulating life should be prepared to face a blurred boundary between forms of expression, regardless as to whether it blossoms into its own discipline.

Neil was exhibited for the first time at ArtBots: The Robot Talent Show organized by Douglas Repetto in 2003 at Eyebeam Atelier in New York City. This was my first experience with an audience that had no preconceived idea as to what Neil was. It was here that, because of an viewers, Neil was transformed from a living sculpture into a robotic performance artist. The audience was nonplussed by the technology, taking for granted that he was robotically alive.

By simply hiding the technology inside Neil's skin, I had successfully transcended the "gee-wiz" factor and ended up in a completely different medium. The audience saw Neil as an accessible art object, who was also supposed to perform in an engaging way; like a person not a thing; a who as opposed to a what. Viewers spoke to him, made faces at him, touched him, and hugged him. This was an outcome I had not anticipated from the vantage of my studio. In hindsight it makes sense that people would anthropomorphize an anthropomorphic robot. This experience has resonated with me since, and completely changed how I see my own sculptures.

Like working with an actor, what Neil communicates and how he communicates has resulted in a completely different works of art. Actors are blank canvases that have the potential to become almost anyone depending on the material they are provided. If Neil makes infantile sounds, he is a baby to be taken care of, if he speaks with authority, people are inclined do as he commands, if he tells jokes and giggles he is understood as a clown.

The open system I created to drive Neil and Iona's emotional behavior has left me with a tool I am just now learning how to use. The paradigm shift leaves me questioning the difference between sculpture and performance. I understand the former, and am still quite perplexed by the latter. By creating a sculpture meant to simulate life, I have accidentally created a pair of living puppets, or cybernetic performance artists. Now that the technology is resolved, I am left with a troubling question, what exactly should they become?

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