Digital Performance Art

Introduction

This is an exploration in the world of digital performance art. It addresses the questions of what emerges when we use digital tools to create performance art? How does this challenge our understanding of those digital tools, their abilities, and their limitations? and How does this challenge our understanding of the principles of performance art? This work contains a report of findings on these topics, an appendix describing individual works of art that comprise the primary research method of the exploration, and an artifact that is the workshop and gallery for those works.

Tools

The use of digital tools to aid in the creation of art is not new. Some tools fade into the background, facilitating a central non-digital focus, while others more directly center digital technology. Digital lighting software in tech for live theatre performances expands possibilities available to theatre productions. It allows complex transitions and fades not possible with older technology, and, more commonly, eases the burden of existing effects on stage crew, thus allowing productions with smaller staff, budget, or time to use lights that would otherwise be out of reach. Reduced prices of digital sound processing and digital cameras similarly serve to slightly expand the frontiers of what is possible while significantly expanding scope of access to existing methods.

Digital photo and movie editing have a more substantial role in unlocking what was previously impossible, even with substantial time and effort using previous technologies. While they still center portrayals of the physical world, these media unlock new possibilities. Once we

turn to digital animation and advanced theatre technology such as Mark Coniglio's Isadora (2001–2020, troikatronix.com), the role of digital tools can shift from aiding creation in a different medium to serving as a full fledged medium of its own. An animated film is created primarily within digital space with the physical world serving ancillary roles and inspiration. And because the digital world is a direct product of the physical world, this inspiration must be absolute. All elements in the digital world could be traced back to the physical world, but this is also true of all media, and is therefore not a particularly complete way to give credit in the process of artistic creation. The role shift of digital tools can be characterized as centering digital products and the medium of digital creation.

What happens when we take this role shift to the extreme? This study attempts to explore that question by creating digital performance art directly from general purpose programming languages. I have produced a multitude of art pieces that each stem from a piece of source code. These pieces of source code do not originate in a vacuum. They draw inspiration from a variety of sources including abstract ideas from the past (e.g. Conway's (1970) game of life (appx. Conway Life)[1]), the ways plants and animals interact in a habitat (appx. Flocking, Biosphere), the mechanics of physics (appx. IDRW 3). The pieces are also shaped by the aesthetic sense of the creator(s) and those they receive feedback from via processes of evaluation and refinement.

The format of source code bears striking similarities to long form poetry. Both can be encoded in a couple pages of text encoded in a language. Both are highly sensitive to small, well chosen changes reshaping the larger picture. Both take some work to fully interpret. Both often follow careful patterns to allude to more than their text explicitly states. In this way, both serve as small encodings of larger meaning. Yet the mediums also bear substantive differences. Source code, at least in the encodings and languages I have used, is much more brittle. Most small changes to a piece of source code will completely break the program, not simply alter its

[1] See the "Conway Life" section of the appendix for an example work by the author

meaning. And source code is interpreted not only by the viewer making sense of the output of the program (a la reading poetry), but also by a computer providing intermediary work in converting source code into an output that is suitable for audience viewing.

Each of these differences shed light on new techniques that can be used to further computational and artistic goals. The languages I used, Python and Java, along with all major text based programming languages in widespread use, suffer from the limitation that most small changes will introduce an error to the program that will prevent a computer from making almost any sense of it whatsoever that is valuable to an audience member. An artist or a developer is also an audience member. When a developer is deprived of this role as audience member, they lose a key form of evaluation that most artists rely on. Imagine not being able to experience the emotional impact of a poem so long as errors in grammar are present. This deficiency gives rise to a new design goal in programming systems: a robustness that allows for experiencing the emotional impact of a piece of code even when errors in syntax are present. While it is out of the scope of this report to provide specific systems that achieve this goal, some possibilities include a relaxed syntax system akin to relaxed grammatical rules of poetry, a generous and intuitive compiler or interpreter akin to a poets ability to see past errors that have yet to be resolved, or a syntax free system akin to some painting styles without discretization, where discrete errors are not possible. Each of these methods, inspired by existing artistic processes, takes a liberating approach that contrasts with the limiting approach used by most conventional ways of avoiding syntax errors such as block based editors, weather visually centered such as Maloney et al.'s (2004) Scratch or textually centered such as Omar et al.'s (2019) Hazelnut. Rather than taking away actions that would lead to problems, an artistic approach challenges us to accept and honor what we previously viewed as mistakes.

We can also take up the challenge to produce meaningful intermediary results, to be productively in process, and to yield swarf which is valuable in and of itself without going so far as to eliminate syntax errors. It is common for artists to value process in and of itself, sometimes

going so far as to motivate an employment process where artists are paid to be in process. This paradigm is possible even in pure computer science. A development style that produces useful swarf may carry more merit than one that does not. As Hempel's et al.'s (2019) previous work in programming languages has touched on, this style better supports the practice of output directed programming where a user edits the output of a program and an automated tool adjusts the source code to generate the new output. Continuous output also supports an effective development style studied and known as live programming (Burnett, 1994). And beyond the scope of conventional pure computer science, swarf aware processes also bring serendipity. We can embrace an intermediary product as a pause in the process and a work in and of itself, elevating and honing what was a mistake into an art piece (Appx. Warped Grids). Ultimately, this approach creates a space more rich with information fit for human consumption

The use of computational power to perform the first stages of unpacking a piece of source code—a transformation that is often out of reach of the unaided human brain—gives us a lens for thinking about artistic impact and how to achieve it. How do we leverage existing powerful forces? The powerful forces can, of course, be computational, but we can also take this question with us outside of the digital world. We can utilize the lived experiences of the viewer by giving them space to meld the presented work with their own past in their viewing experience; triggers of empathy in the viewer such as a visage of themselves or their loved ones; or well trained mechanisms of thought the viewer possesses such as linguistic processing or domain specific knowledge such as mathematical pattern finding, sociological reasoning, or drawing historical parallels. Ultimately, this use of computational power may challenge artists to consider how to effectively utilize existing tools that they or their audience have at their disposal.

Media

Art can take countless forms embedded in countless media. Some classic media include still images, audio, written and spoken language, and physical coexistence as in dance and theatre.

Many artists continuously reimagine the media they use, and this study is no exception. Digital technology can expand access to interactive artwork to spaces and times that the original human artist(s) do not occupy, can enable an artist to develop a system for automatically personalizing artwork to audience members who have yet to arrive, and can allow for pieces that are unique, viewable once only, and/or generated live, all without the physical or temporal presence of the artist. These media are unlocked by turning over the final stages of the artistic process to a computer. And a computer is able to perform far more advanced artistic tasks than previous technologies that filled that role such as printing presses, projectors, or copying machines. If used carefully, a computer can come closer to filling to role of a dance company embodying choreography or a theatre production team enacting a play. The computer, under the absentee auspices of the original artist can seek to gather new meaning from the world and embed it in the piece without direct intervention by the original artist. Some specific mechanisms by which a computer can gather information not encoded in source code include, using a live camera feed, collaging together user provided video clips (appx. 6), using previously composed music to guide a visual as is common in dance (appx. Conway Life Music), directly engaging a user as artist (Dance Education Laboratory, 2017), or using or using an external source of randomness, a common thread throughout my works. In these ways the computer and audience members who tend it can be elevated to the level of collaborators.

The concept of empowering a computer to go beyond the intentions and abilities of the original artist is not new. It has revolutionized computer science under the label of machine learning and has already begun to enter the world of digital art (Gatys et al. 2016). The intersections between the principles guiding machine learning and the principles guiding the novel enactments of plays and the art of writing a play that effectively leaves agency to actors and producers are outside the scope of this report, but quite intriguing, nonetheless. The close connections between a fledgling field with massive practical applications and a field as old as antiquity in perpetual search of novelty may bear fruit.

Teasing Apart Conventional Artistic Notions

Digital technology challenges classical notions of liveness and uniqueness. As the fidelity of delayed viewing technology increases, it becomes easier to imagine a virtual reality system which, from a sensory perspective, is indistinguishable from a live performance. Yet this is still not a live performance. This discrepancy forces us to look beyond sensory aspects of live performance. We can no longer cite an absence of microscopic visual detail and its subconscious effect as what makes a recording not live if we can capture visual detail at a level beyond what is biologically perceptible. We will no longer be able to cite the smell of a performance venue if future technology allows us to precisely recreate that smell. We must now consider other notions of liveness. The potential for an unexpected deviation from the plan, the potential for an impromptu connection with a fellow audience member or performer in the space and time in between the formal performance. Perhaps liveness is not about the art itself but the potential to unlock things outside of the piece. Perhaps liveness is the knowledge that an action by the viewer may, however unlikely, influence the piece itself, that the information flow is bidirectional. Perhaps liveness is knowing that once you experience something you can never go back and never experience it again.

These new notions are naturally reframed as challenges for digital performance art to take up in the pursuit of liveness and the magic that seems to only be possible in person. Can a piece be interactive? Can a piece carry threads of connection that lead viewers to a specific place with potential for interpersonal connections in the wider world? Can a piece happen only once, leaving no record outside the minds of the viewers (appx. 6)?

Appendix of Works

This report refers to several art pieces that are described in this appendix and present in the accompanying artifact at github.com/LilithHafner/DigitalPerformanceArt.

Conway Life

2018–2021. Found in the artifact at *Gallery/Conway Life*

These works center John Conway's (1970) game of life. Each piece simulates a single world of live and dead cells whose progression follows the rules of Conway's game of life:

- A living cell with 2 or 3 living neighbors will survive.
- A dead cell with exactly 3 living neighbors will become alive.
- All other cells will die or remain dead.

Surrounding this core simulation is a source of perturbations to continuously seed the simulation and a rendering system to present the simulation to a viewer. The most common source of perturbation is randomly determining the liveness of cells at the border of the space according, following a day/night cycle a few minutes long. This results in unique pieces of unbounded length and a chronological variation in the qualitative nature of the piece. The most common rendering system considers the future and past of each cell and uses chronological proximity to liveness to determine the rendered shade and color. This approach highlights motion and hides stillness, thus concealing static formations and stable formations with short oscillation periods.

Interfacing with sound, several pieces render life aurally, and one uses a piece of music as its perturbations rather than random noise. The latter, referred to in the report, can be found in the artifact at *Gallery/Conway Life/Python2/music*.

Flocking

2017. Found in the artifact at *Gallery/Flocking*

An interactive simulation which imitates biological flocking behavior. A collection of abstract animals are displayed wandering an empty field, and three sliders allow the user to control the mechanisms which guide their travel. No explanation of what each slider does is provided, instead leaving to the user the challenge of moving them around and interpreting changes which are immediately reflected in flocking behavior. This system meets Burnett's (1994) most stringent criteria for immediate visual feedback.

Biosphere

2021. Found in the artifact at *Gallery/Biosphere*

A collection of ecologically inspired pieces set on an infinite Euclidean plane mapped to a finite open disc. A collection of abstract plants struggle to exist in a world lit only in the center with darkness elsewhere. When two plants overlap, only one survives. Various pieces utilize different mechanics to resolve this conflict, resulting in different visual and emotional impact.

Improvisational Dance Robotics World (IDRW)

2020. Found in the artifact at *Gallery/Improvisational Dance Robotics World*

A progression of three pieces beginning in a minimal example that meets Celeste Miller's definition of dance as "movement, aware of itself, practiced with intention" and gradually increasing in complexity:

1. A single circle, changing size at random, utilizing awareness of its current size in relation to available space to guide that randomness in order to meet an intention of staying at a visible size.
2. A single circle, moving about in an infinite hyperbolic space projected onto an open disk and set on a stage which highlights the outline of that disk. Motion is inspired by momentum, with constant kinetic energy and speed, but randomly perturbed direction. This circle uses a similar awareness to the circle in 1 to remain visible near the center of the infinite space.

3. Three circles moving according to a warped notion of gravity through the same space as 2, each with its own system to determine its color based on the positions and velocities of each member of the ensemble. The piece is set on a stage whose color changes according to the total kinetic and energy of the system. When deviations from conventional physics and the failure of conservation of energy become too extreme, each circle and the set strike a final pose and the piece comes to an abrupt conclusion. This is one of few pieces in the artifact with a choreographed storyline of finite chronological duration, but is nevertheless improvisational. Following in the footsteps of improvisational comedy which is often inspired by a single word from the audience and continues without external direction, this piece starts with a small random perturbation and continues deterministically, yet chaotically thereafter, yielding a unique performance each time the piece is shown.

6 2021. Found in the artifact at *Gallery/6*

An experiment in perceptions of storytelling. This piece is composed of a collection of movement moments and a script which weaves them together into a narrative. Through intentional creation and curation of source material and careful framing, this piece explores the possibility of empowering a computer program to elicit the emotional resonance of a story with unique meaning using a random number generator as the sole source of uniqueness. As part of the framing of this piece, and as an experiment in liveness, each work is automatically titled, choreographed, shown once, and explicitly and permanently deleted.

This work presents a moral question of artistic honesty: what are the moral ramifications of falsely presenting a work as bearing meaning? While it is fair to claim that the individual source clips bear meaning or that the structure of possible arrangements bears meaning, the specific choice of which arrangement to use, which is also the aspect which creates uniqueness between showings, and is the aspect which this piece attempts to imbue with apparent

meaning, is sourced directly from a random number generator. In this act, I violate an implicit promise of artistic integrity that every element is intentional, especially those that I highlight. In this act, also, I create a frame for meaning, and present it to the audience empty, for each viewer to fill with their own meaning, creating a space for guided artistic interpretation of their own projections.

Warped Grids 2021. Found in the artifact at *Gallery/Warped Grids*

A collection of swarf from the projection of Biosphere's infinite plane projected to a finite open disk. Perhaps the most visually stunning imagery in the artifact, this swarf emerged from a process that sought first to create meaningful output, and only then to gradually coerce that output into line with an artistic vision.

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