Designing Art Through Embodied Participation

by

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Introduction

Today, artists use code as a creative tool, building systems that respond to facial expressions and gestures. Rather than presenting fixed compositions or static installations, these works invite the viewer to become a participant. Visuals and sounds are shaped live by the user's body, turning passive observation into embodied interaction. This shift in control—from artist to system to participant—blurs the line between creator and audience.

Interactive systems driven by real-time input, such as facial recognition or hand tracking, challenge traditional ideas of authorship and presence. They encourage learning and discovery through physical engagement. For new media artists, these systems offer both creative freedom and deeper audience connection.

This paper explores how artists use embodiment to design interactive systems where real-time input transforms users into co-creators, empowering them as both performers and participants.

History of Interactivity, Embodiment, and Play in Media Art

Artists began incorporating responsive elements into their works in the mid-20th century. Figures such as Nicolas Schöffer, James Seawright, or Edward Ihnatowicz built mechanical sculptures and environments that reacted to the viewers or the surrounding environment. These early experiments laid the groundwork for what is now known as interactive art. In 1990, the prestigious Ars Electronica Festival created a dedicated category for interactive art, signaling the emergence as its own distinct art form (Kwastek). Since then, interactive art has gained popularity within the field of new media, and debates continue over how to define “interaction” in an artistic context.

The core concept of interactive art involves a dynamic relationship between the artwork and the audience, where the audience’s actions directly influence the outcome of the piece. The art’s aesthetic and meaning arise through the viewer’s active participation, gestures or decisions they make, or data they input become part of the artwork itself. In interactive works, the viewer’s role moves closer to performer or co-creator. The audience member is not just observing; they are exploring, controlling, playing, or even co-authoring the piece’s outcome. This is different from works that only involve physical interaction, like sculptures you can touch or climb. These might use the body, but don’t react to the viewer’s actions. True interactivity is a two-way exchange; the system responds in real-time to the participant, creating a feedback loop that makes the audience part of the artwork as it changes.

Embodiment in this context refers to the way interactive art engages the human body as a part of the artistic experience. Rather than treating the viewer as a disembodied viewer, these works rely on physical movement or biofeedback as triggers. In interactive art, embodiment means that the artwork is experienced through the body; the viewer’s bodily position, motions, facial expressions, heartbeat, and more become artistic material. Interactive installations often amplify our awareness of our own bodies by making the art’s response dependent on our physical presence and actions.

Another key concept intertwined with interactive art is play. Many interactive art pieces have a playful character, inviting open-ended exploration and experimentation in ways similar to games. Interactive artworks often create a safe space where viewers can experiment physically, try things out, and learn by doing without fear of doing something wrong. In gallery settings, one can observe children and adults alike, playing with the artwork, making faces and gestures to see how it reacts. As art historian Katja Kwastek notes, the aesthetics of interaction often overlaps with an “aesthetics of play”, in which the joy of discovery and the act of playing become essential to the artwork’s meaning (Kwastek 71). Within these interactive systems, play becomes a mode of understanding, the audience learns about the system’s behaviour through trial and error, and in doing so, they also explore the artwork’s themes on a more visual level. Interactivity, embodiment, and play are integral to new media art. Understanding their history and definitions clarifies how modern artists came to create works that blur art with game, audience with participant, and viewing with doing.

Audience Participation and Real-Time Systems

New media artists have developed a wide range of projects that illustrate how real-time input and bodily engagement turn viewers into participants. For example, many of Lauren McCarthy’s projects explore surveillance, emotion, and connectivity in modern society. Her 2020 project, *Vibe Check,* extends throughout a gallery space, making use of facial recognition and emotion detection algorithms to observe visitors’ facial expressions and interactions. The installation essentially monitors the emotional vibe that people generate in a space. As visitors walk in, the system identifies certain individuals as having a strong emotional effect on others. For instance, it might determine that one person tends to evoke smiles and happiness in those around them, while another person gives off a discomforting presence. This information is fed back into the gallery in an immediate, playful way; people are alerted in real-time to who the viewers labeled with “happy” or “disgust” are in the room (McDonald and McCarthy). The piece requires the physical presence of participants and captures subtle embodied signals like facial expressions as input. McCarthy has designed a system where the audience's own faces and moods become the content of the artwork. The agency shifts to the audience; without their expressions, the piece has nothing to analyze or display. *Vibe Check* blurs the line between playful social experiment and surveillance commentary.

Rafael Lozano-Hemmer is known for his large-scale interactive installations that incorporate biometric data and audience participation. His 2006 project, *Pulse Room,* is an installation featuring hundreds of clear incandescent light bulbs hanging in a grid. Upon entering the installation, a visitor can hold a sensor interface that detects their pulse through their hand. When a heartbeat is detected, the nearest light bulb begins to flash rhythmically in time with that person's heart rate. When the participant lets go, their recorded heartbeat pattern is added to the array; all the lights briefly go dark, the sequence shifts down the line, and their pulse becomes one in a series of blinking bulbs. Each bulb flickers with the recorded heartbeat of a different participant, including the most recent visitor's living pulse (Lozano-Hemmer). *Pulse Room* transforms a normally invisible, internal bodily process, the heartbeat, into a collective visual experience. The artwork quite literally embodies the audience. In this project, the role of the artist is to design the system and frame the experience; the content is generated by the participants. Without people willing to lend their pulses, the room remains dark and static. But as visitors become performers, the space comes alive with pulsing lights. Each visitor leaves a piece of themselves behind as their heartbeat continues to flicker in the grid, giving a sense of connection and authorship.

Golan Levin's work frequently invites audiences to engage in imaginative, tech-driven interactions. The 2014 *Augmented Hand Series* is a collaboration between Golan Levin, Chris Sugrue, and Kyle McDonald, which introduces an interactive software system that reacts to the user’s hand gestures. Visitors place their hand under a camera and see a real-time image of their hand augmented on a screen with surreal modifications. Their fingers stretch extremely long, multiply, or morph into strange shapes in response to their movements. This piece uses embodied interaction in a very direct way; the artwork is essentially a digital mirror that reflects user’s physical hand motions, with the addition of creative transformations. Users can move their hands, wiggle their fingers, or make specific poses that influence the generated visuals (Levin). The *Augmented Hand Series* provides an experience of discovery and play, and exemplifies how new media artists use real-time motion tracking to turn simple bodily actions into interactive experiences. In doing so, Levin and his collaborators hand over a sense of creative control to the audience.

Camille Utterback and Romy Achituv’s 1999 *Text Rain* highlights how embodiment and play can turn viewers into co-creators. In this installation, a live silhouette of the viewer is projected as colorful letters fall over them like rain. The falling letters form lines from a poem about bodies and language. Participants discover that by using their bodies, they can catch and lift these falling letters on screen. If a person raises their arm, the letters will land on the arm in the projection as though it were a physical surface. The letters respond in real-time to every motion; when a participant moves away, the letters that had piled up on their silhouette fall again due to gravity simulation. Users can form entire words or lines of the poem if they are patient enough (Utterback and Achituv). This piece vividly demonstrates embodiment by requiring participant’s bodily presence before the text can be read at all. Participants feel directly responsible for arranging the falling poem, and each participant’s motion leads to a unique composition of text on the screen, creating a strong urgency of co-creation. Although the artist wrote the code and selected the poem, it is the audience who brings the piece to life.

Authorship, Play, Agency, and Co-Creation

The rise of interactive, real-time art installations has challenged traditional ideas of authorship and artistic control. In traditional art forms, the artist is the sole author of a finished piece, and the audience's role is to interpret or appreciate a completed artwork. With interactive art, the artist's role shifts to designing a system, a set of possibilities or rules, while the performance and outcome emerge through audience participation. As artist Dick Higgins described in *Games of Art*, the artist becomes more like a game designer, creating conditions for experience rather than controlling the final result (Higgins). The authorship is shared between the artist and the audience. Media art theorist Roy Ascott, who was an early visionary of interactive art, proposed that the interaction between the spectator and the artwork is the core of art (Telematic Embrace). Ascott and others in the 1960s advocated for an art of feedback and behavior, where the viewer's actions become part of the artwork's form. In 1957, artist Marcel Duchamp stated that "The spectator brings the work in contact with the external world by deciphering and interpreting its inner qualifications and thus adds his contribution to the creative act" (qtd. in Wang et al.). Duchamp's quote foreshadowed interactive art by suggesting that art is not complete without the viewer's interpretation. In interactive media art, the viewer's physical contribution becomes part of the artwork. When a visitor's heartbeat lights up Lozano-Hemmer's *Pulse Room*, or a museum-goer's gesture catches letters in *Text Rain*, the viewer is actively contributing to the artwork's state in that moment. The authorship of the work unfolds as a collaboration.

The element of play in interactive art also ties into theoretical discussions of agency and learning. Play scholar Miguel Sicart describes play as a method of sense-making, and an appropriative activity where players give meaning to a set of rules (Sicart). In interactive art installations, the audience plays with the artwork, learning how the system responds and often finding creative ways to generate surprising outcomes. This behavior aligns with what educators and theorists call experimental or constructivist learning; people understand a system by actively engaging with it and observing results. The audience's sense of agency, their feeling of control, and their ability to effect change are closely linked to the play element. A well-designed interactive artwork will balance guidance and freedom to ensure participants feel empowered to explore without becoming frustrated. When successful, this creates a feedback loop of agency; the participant acts, sees the artwork change in response, and is motivated to continue acting and exploring. The pleasure of seeing one's own impact on an artistic system is profound, it produces a feeling of personal connection to the work.

Underlying these shifts is a blurring of boundaries between performer and audience, a concept also explored in performance studies and media theory. Interactive media art often turns spectators into performers, as explained in the case studies. New media interactive art makes use of technology such as sensors, algorithms, real-time graphics, etc., to facilitate this exchange of roles. The computer or software in these systems acts as a bridge, constantly shaping the interaction between all participants, including the artist. Some theorists describe this as a distributed agency, where the agency is distributed among the human participants and the non-human system. New Media scholar Steve Dixon notes that in digital performance, authority can become "decentered," located in the relationship of performers, audience interactivity, and programmed media (Dixon). This decentering is present in interactive art installations; agency is shared between the artist who made the rules, the software that executes responses, and the audience that inputs live data. However, sharing authorship like this raises the question: who creates the art in an interactive piece - the programmer, the program, or the participant? A commonly accepted answer in the field is all of the above, each is a necessary contributor to the artistic outcome. At the same time, this co-authorship is not entirely equal. The artist still holds primary authorship by designing the system, defining the parameters, and setting the limits of what the participant can do. The participant brings the work to life, but always within a structured framework created by the artist. The system itself, even though it's autonomous in its responses, is also a reflection of the artist's intent and technical design. In this way, authorship is shared, but not evenly distributed. The artist remains the architect, while the participant becomes an essential, but bounded, collaborator.

Co-creation captures the shift in how audiences relate to art, they're not just consuming it, but helping to make it. This happens in real-time in an interactive installation and is often collaborative. In some cases, multiple visitors are present and co-create with each other. For example, multiple people in *Pulse Room* each add their heartbeat, the light show is a product of their combined inputs. Even when one person at a time engages, as in *Text Rain*, they are co-creating by merging their personal expressions with the artist's framework. The artwork is open-ended and invites completion by the audience. The nature of these works can be very empowering to audiences, viewers shift from passive receivers to active participants, with an influence on the outcome. This allows audiences to feel a greater sense of engagement and personal connection to the art, and provoke reflection. By making the audience responsible for what happens, interactive art encourages people to consider their own role and behavior. For example, a viewer might reflect on how their mood influenced *Vibe Check's* atmosphere, or how their heartbeat in *Pulse Room* made them feel vulnerable yet connected to strangers. In this way, co-creation strengthens the themes of shared authorship, social connection, and human and machine collaboration.

Summary of Key Ideas

The examples and theoretical discussion above reveal many key ideas about embodiment and real-time interactivity in new media art. First, interactive art represents a shift in practice from static presentation to responsive systems. Artists no longer solely create finished pieces; many now create environments for interaction where the presence and actions of the audience complete the work. This shift confirms early ideas from Duchamp and Ascott that the audience would become a key part of the art-making process.

Second, the use of real-time input, such as gestures, facial expressions, movements, or biometric signals, has enabled a deeper form of embodied engagement. By making use of technologies like motion tracking and sensors, artists create works that respond instantaneously to the body. This turns the artistic experience into something much more physical and personal as viewers become participants. In works like *Text Rain* or *Pulse Room*, participants physically feel their role in the artwork, which reinforces the concept that the audience's presence is central. The viewer's body is in the artwork, blurring boundaries between subject and art object.

Third, the agency in the creative process is decentralized. Control flows from the artist to the system to the participant, creating shared authorship. The artist programs the possibilities, the system executes rules autonomously, and the participant influences the outcome; a feedback loop that continually shifts authorship. Yet, even as participants appear to shape the experience, their range of actions is preconditioned by the artist's design. In this sense, the artist not only builds the system but subtly scripts the participant's role within it. These interactive works can be seen as collaborative performances between the artist, the system, and participants. The audience is empowered to explore and even challenge the work within the given parameters, making each experience unique. The art does not exist in a fixed state, it's a dynamic process that evolves with each interaction.

Finally, these practices highlight the importance of play and discovery in new media art. The audience learns the artwork's parameters by playing with it, and in doing so, they find meaning and enjoyment. This shows a wider shift toward media that invites participation and experience. It also makes art more inclusive; people of all ages and backgrounds can connect through direct interaction instead of feeling pressured to understand it passively. Interactive artists build play into their work, encouraging intuitive, hands-on engagement. This kind of engagement can be more impactful and memorable, creating a personal connection between the participant and the artwork.

In conclusion, new media artists who use embodiment and real-time input are redefining the relationship between creator and audience. They turn users into participants and observation into interaction. The examples of McCarthy, Lozano-Hemmer, Levin, Utterback, and others show how visuals and sounds can be shaped live by the user's body. Agency is shifted from the artist to the audience by distributing creativity across a system that includes viewers. This empowers audiences as both performers and co-creators, providing a deeper connection to the art. In these embodied interactive systems, art becomes a shared experience, a space of learning that blurs the line between who the artist is and who the audience is. Practices like these point to a future where art is not just seen or consumed, but actively shaped through our interaction with responsive systems, making meaning a shared creation between human and machine.

Introducing My Project, Feedback Loop

My project, *Feedback Loop*, is an interactive audiovisual system that responds in real-time to a viewer's facial expressions and hand gestures. Using a webcam, Python detects emotional states and hand gestures, which are sent through OSC to a Processing sketch that plays visuals and sound. The piece is built around the idea of embodiment and co-creation; rather than presenting a fixed work, it invites participants to explore the system with their bodies. Each expression or gesture becomes an input, data that shapes what the work becomes in that moment. This concept grew from my research of interactive art systems that shift authorship from the artist to the audience. Like in the case studies previously explored, my installation cannot operate meaningfully without human presence and input, and in this sense, the viewer’s participation becomes the artwork.

The origin and Initial Vision

I’ve been making music in Ableton since 2017, and over time, I became interested in procedural and generative systems; ways of building sound that evolve on their own. I started designing effect chains that used randomness and probability to let a single note branch off in different directions. The pitch could vary within a scale, the sound could trigger different instruments, and the effects, like reverb or distortion, were all randomized. It created a loop that never repeated the same way twice. This approach laid the foundation for my first idea: a sound system inspired by Andrew Huang’s plant biofeedback setup, where signals from plants are converted into music using modular synths (Huang). I liked that it combined generative music with a strange, unpredictable input. At first, I planned to build a modular setup using electrical signals from plants to trigger modular instruments. But as I sat with the idea, I realized it was missing the human element; there was no room for play or exploration. Viewers would stand and watch this static installation work on its own. I thought about letting viewers influence the plant with light or water, but it still felt too distant. I wanted something more immediate and personal, something that responded to the body itself.

This brought me to the idea of a sensor-based system, where I could track participants using proximity, motion, light, and audio sensors. Each sensor would capture a different kind of data from the environment: how close someone was, how fast they moved, the shadows they cast, or the sounds they made. I imagined connecting these sensors to an Arduino or Raspberry Pi, sending the data into Processing, and using it to trigger and shape sound as an output. Each input could affect a different parameter: proximity might shift pitch, motion could control the note speed, light could adjust a filter, and audio levels might keep the overall volume balanced in response to the gallery's noise. I liked the technical challenge of wiring it all together and figuring out how to position the sensors in a gallery space. But the more I thought about the experience from a visitor's perspective, the more uncertain I felt. Would people know where the piece began and ended? Would they understand how they were interacting with it? The concept felt too general, there was too much mystery and not enough feedback. I was looking for something more intimate. I didn't want the interaction to feel like a hidden trick, I wanted it to feel intentional and direct.

That's when I started exploring the idea of turning an elevator into an interactive sound space. I imagined using environmental sensors, switches, or even the floor selection as input, with data processed by a Raspberry Pi and sent to Processing to generate sound. A camera lens mounted in the elevator could track body movement, while wall-mounted switches might control aspects like the scale or texture of the audio. I pictured the system reacting to the number of people inside, maybe with fewer people, the sound becomes minimal or lo-fi, and with more people, it builds into a full arrangement. The concept had a mysterious, playful quality; participants wouldn't know right away what was being triggered, but could learn by riding the elevator. But the technical and ethical challenges quickly stacked up. Where could I place the camera to reliably track visual data? How would I mount the speakers without disrupting the space? How would I get power to the electronics and hide the wiring? And more importantly, who would I need permission from to install a camera in a non-gallery location? Would people need to know they were being recorded? The logistical issues were bigger challenges than I anticipated. I also learned that older Raspberry Pi models struggled to run Processing code with real-time webcam data, and I would have to rely on the lighting conditions of the elevator for the camera to accurately track visual data. The hassle of troubleshooting, installing, fixing, and reinstalling the code in such a restricted space also seemed challenging. However, the biggest problem was time: elevator rides are brief. There wouldn't be enough time for viewers to fully engage with the system, let alone explore it in a meaningful way.

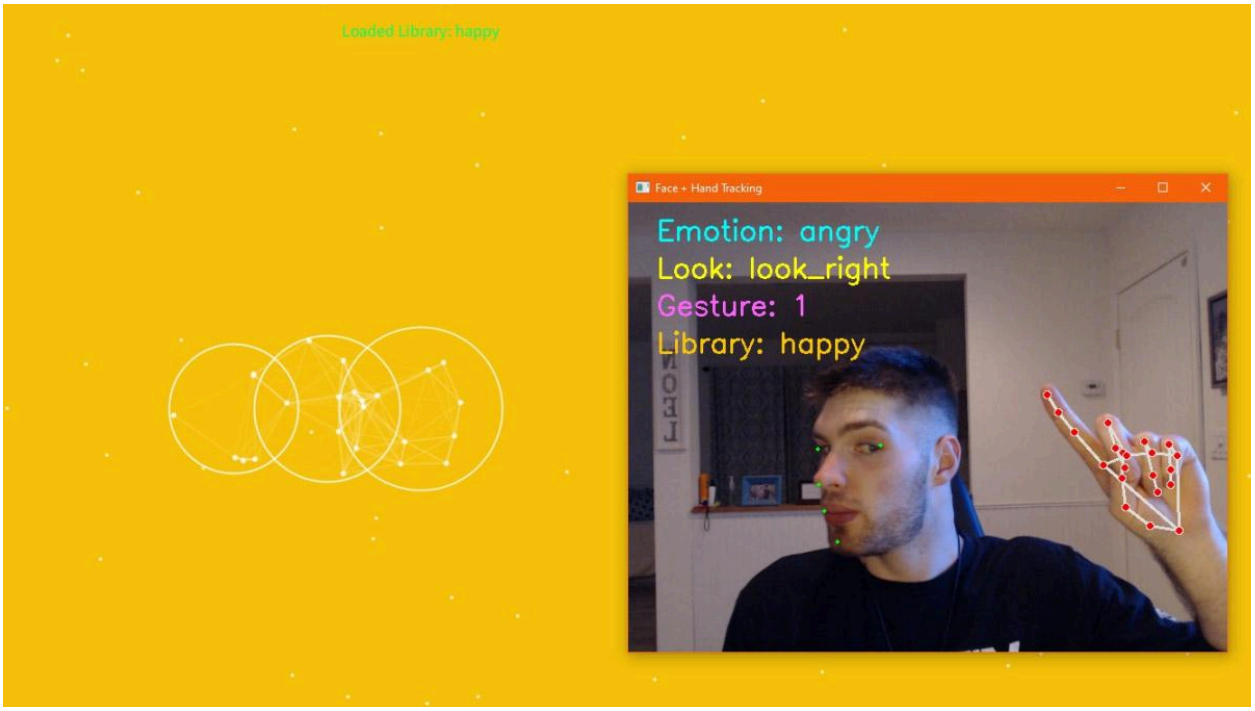
Evolving the Concept and Building the System

After letting go of the elevator concept, I began thinking more critically about the interaction that could happen in a gallery space. I started experimenting with facial detection and simple motion tracking, and quickly realized this approach offered the kind of intimacy and embodiment I had been trying to achieve. By using a webcam and software to track a viewer's expressions and gestures, I could build a system that felt more responsive and personal. This shift marked a turning point for me: it was the first version of the project that had felt both technically achievable and conceptually aligned with my goals. It brought the focus back to the body, to play, and to the idea that the viewer doesn't just trigger the work, they actively shape it.

Once I had committed to using facial expressions and hand gestures as input, the technical side of the project began to take shape. I used Python as the backbone for detection, combining MediaPipe for hand tracking and FER (Facial Expression Recognition) for emotion analysis. OSC was used to send this data in real-time to a Processing sketch that handled sound and visuals. Early versions of the system relied on DeepFace for more detailed emotion recognition, but it proved unstable with real-time interactions by returning incorrect values, especially under inconsistent lighting. I eventually switched to FER, filtering four emotions that tracked more reliably: neutral, happy, angry, and surprise. To simplify the system and prevent crashes, I implemented a cooldown timer between emotion and gesture updates. An emotion paired with an "OK" hand gesture would load a corresponding sound library. Each library had a folder of six .wav files, which could be triggered by showing fingers 0 through 5. I also implemented a global cooldown of half a second to prevent overlapping audio triggers, and a 30-second inactivity timer to reset the system to a neutral state when no one was interacting. This helped avoid accidental sound playback after a participant had walked away.

Throughout development, I hit several setbacks. A non-technical setback I faced two weeks leading up to the showcase was my health. On April 10th, I tested positive for mononucleosis, only 13 days before opening night. I was extremely fatigued, I could barely leave my bed, my tonsils were inflamed to the point they were almost touching, and I was unable to speak. Counting down the days until our showcase opened, I went to my doctor, got my blood drawn, and was put on the steroid Prednisone. A few days after starting medication, my tonsils returned to their normal size, and I had enough energy to resume coding my project. At this point, I was working overtime to make sure my project was functioning correctly. During the week leading up to the showcase, I was coding and troubleshooting for about six hours a day. Python library conflicts led me to rebuild the entire environment from scratch and set up a virtual environment that preserved the exact package versions I found to work.

An earlier version of my Processing sketch featured ripple effects and background particles that reacted to sound. It even included gaze tracking, which altered visuals depending on whether the user looked left or right.

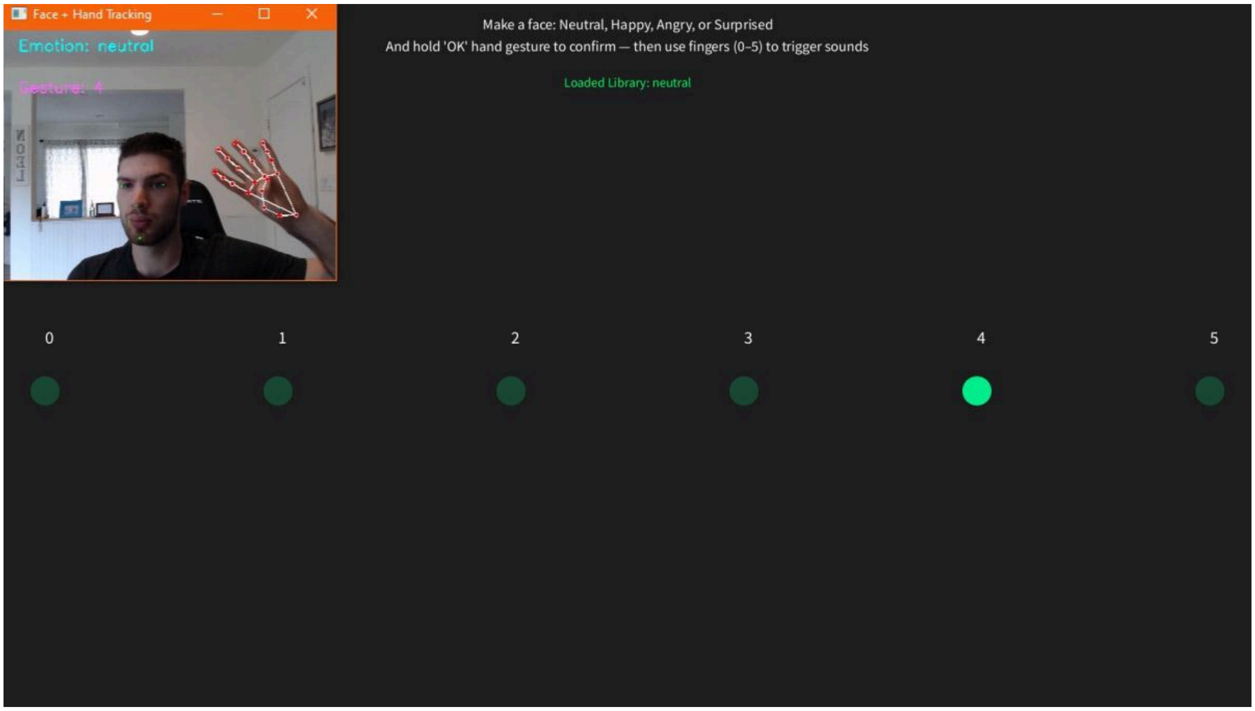


Loaded Library: happy

Emotion: angry
Look: look_right
Gesture: 1
Library: happy

Figure 1. Original visual system with gaze tracking, ripple animations, and particle effects. Photo by John Schroeder.

However, this visual system continuously crashed due to a Processing error: "ConcurrentModificationException." The error stemmed from modifying a particle list while looping through it, which Processing doesn't allow. I had already been troubleshooting the error for several days when I brought my installation into the gallery. I wiped and repurposed an old PC I had built in 2019, reinstalled Windows, and cloned the scripts and environment over to it. On the day before the showcase, I brought all my equipment into the gallery and began setting up my installation. Once I loaded my scripts, the same Processing error reappeared. I decided it was safer and more stable to rework the visual system instead of troubleshooting it until the end of time. I wanted to provide clearer feedback as to how the system was responding to the user's actions rather than have complicated, flashy visuals. So I began coding and testing the new visual system I had in mind, in the middle of the gallery space, for the next 4 hours.



Emotion: neutral

Gesture: 4

Make a face: Neutral, Happy, Angry, or Surprised
And hold 'OK' hand gesture to confirm — then use fingers (0-5) to trigger sounds

Loaded Library: neutral

Figure 2. Final visual system with simplified gesture indicators. Photo by John Schroeder.

Designing for Interaction

Making the system intuitive and engaging was one of my top priorities. I didn't want viewers to be confused or unsure whether they were successfully interacting with the piece. To solve this, I focused on creating clear visual and audio feedback for every action. Once a user made a facial expression and held the "OK" hand gesture, the system confirmed their emotion by loading a matching sound library, playing a confirmation chime, and shifting the background color to reflect it (yellow for happy, red for angry, blue for surprise, and gray for neutral). This immediate color feedback helped make the system feel alive and reactive, even before any sound was triggered. I also included brief instructional text at the top of the screen to guide users through the experience.

After confirmation, gesture indicators became the main visual interface. Six numbered circles appeared across the screen, one for each gesture 0 through 5. When a user raised their fingers, the matching circle would briefly light up and trigger a sound from the corresponding audio layer. These indicators acted as simple, readable UI elements that showed how the user was interacting with the system. Additionally, users could understand the rules just by experimenting.

I purposely created a visual system that encouraged learning through play. Instead of overwhelming participants with complexity, I focused on responsiveness and clarity. Early versions of the project had more elaborate effects, like ripple trails, visual changes based on gaze, and ambient particles, but these were replaced with minimal, intentional cues. The feedback loop between gesture and response let participants feel like they were discovering how the system worked with each new input. I also included a deactivation timer where, if no new gesture was detected for 30 seconds, the system would reset to a neutral state.

In the end, the interaction design supported the same ideas explored in my research: that embodied play can serve as both a method of sense-making and a form of authorship. Participants didn't just press buttons, they used their bodies to learn and shape the output. The system was built to invite curiosity and reward discovery, not just visually but through sound as well. I used pre-recorded sounds for the audio of my project. Each gesture triggered a different sound layer, and I made sure they would still sound pleasing even when played in a random order. This meant sticking to one scale, but having enough variation between the notes so they didn't sound too similar or repetitive. I tested different combinations to make sure the experience felt playful and harmonically satisfying. I even added an easter egg, if a user flips the webcam off by raising just their middle finger, a fart sound effect plays accompanied by the screen briefly turning green and flashing the word “fart.”

Gallery Installation and Reactions

On the day of the showcase, I spent the morning adjusting the system to better fit the gallery space. My friends who were also setting up their projects helped test my setup. At first, I had the installation facing the center of the room, but I realized this made it too easy for bystanders to accidentally trigger the system.

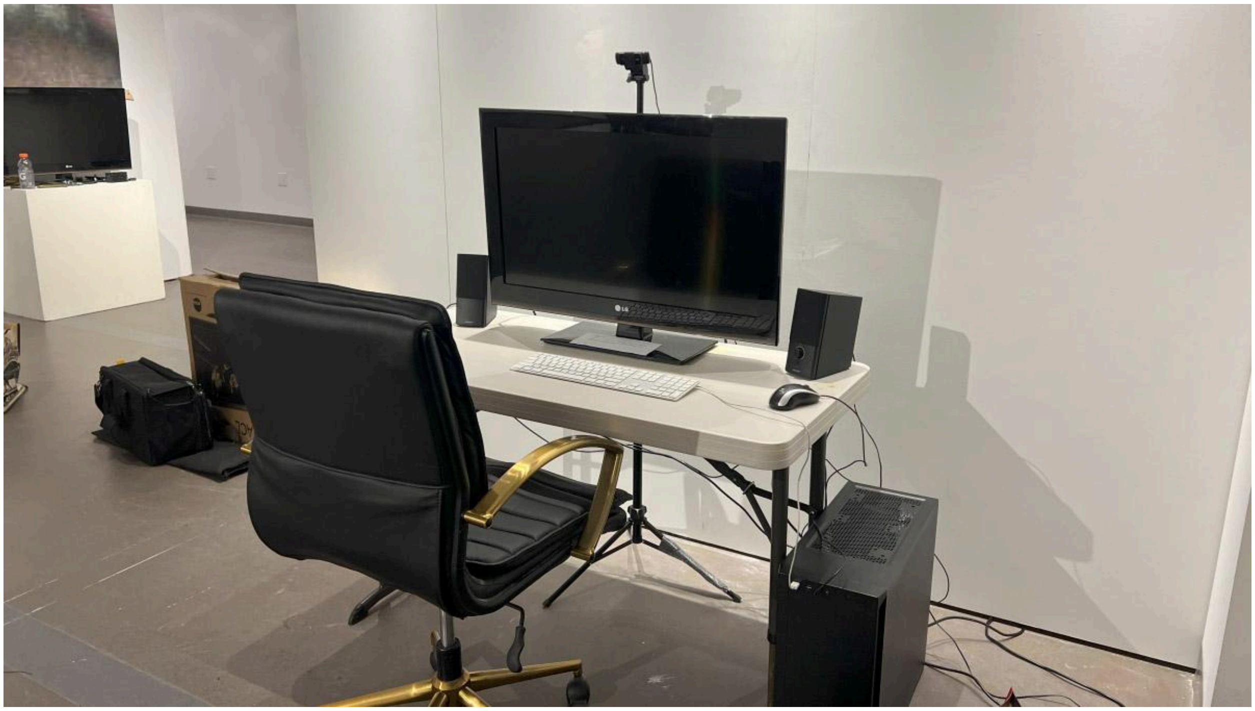


Figure 3. Initial setup facing the center of the gallery space. Photo by John Schroeder.

If the hand tracking lost the primary participant, it would jump to the next visible hand, usually someone standing nearby, and wouldn’t return to the original user unless the other hand left the frame first. I experimented with distance scaling in my Python script to prioritize the closest hand, but the results weren’t consistent. The system still seemed to favor the first hand it detected, regardless of distance. To fix this, I rotated the entire setup to face a wall, narrowing the webcam's field of view and encouraging one person at a time to sit in the chair and engage.

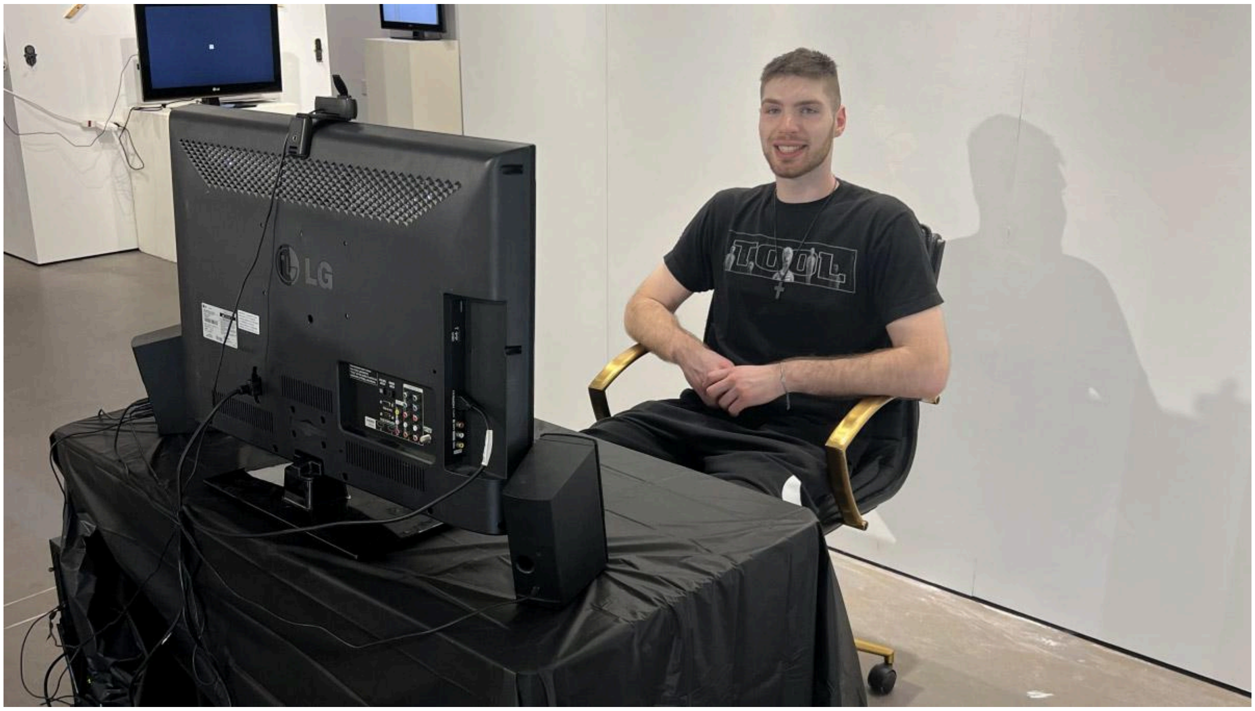


Figure 4. Final Installation setup facing the wall. Photo by John Schroeder.

I also cleaned up the wiring with zip ties and covered my white table with a black cloth to make the setup look neater and hide the wires. To help with facial recognition and reduce frame noise, I opened the blinds to let in more natural light.

Once the evening came and the showcase opened, people immediately began experimenting with my installation. Some decided to read the on-screen instructions, while others started making faces and throwing up hand gestures at random. The system didn't need perfect instructions to function, and for me, that was the beauty of it. Even when people made unsupported expressions like sad faces or gestures like thumbs up, the system responded accordingly by snapping to the closest recognized input. Sad defaulted to neutral, and thumbs up was often read as a fist, triggering gesture 0. These outcomes weren't bugs, they were the result of carefully chosen restraints. Just like how I limited emotion recognition to four clear expressions, I also kept the gesture system simple, because more complex landmark detection (like distinguishing a thumb extension) wasn't reliably read by MediaPipe. The result was a cleaner, more stable interaction.

Some people tried to push the limits of the system by rapidly changing between hand gestures to see what would happen. The half-second cooldown I implemented prevented crashes and kept the experience responsive. Others discovered the hidden easter egg of flipping the system off to trigger a fart sound effect which became a shared joke. Previous users began telling new ones to try flipping the webcam off. It was one of many moments where the installation felt alive, users weren't just reacting to the system, they were engaging with it, shaping it, and even influencing how others approached it.

One thing I noticed was how similarly kids and adults engaged with the system. Children tended to ignore the on-screen instructions and jumped straight into making faces and gestures, not worrying about how the system worked. They smiled as circles lit up and sounds played, repeating their actions to see what else would happen. Adults, in many cases, learned the system the same way, through play and experimentation. Their movements were usually more deliberate, but the outcome was the same: discovery led to understanding, which led to enjoyment. This mirrors ideas from my research, particularly from scholars like Miguel Sicart, who describe play as a universal form of sense-making (Sicart). The fact that users of all ages could learn the system by interacting with it highlights the importance of intuitive design and embodied feedback. It wasn't just accessible, it was genuinely fun for people, regardless of age or background.

By the end of the showcase, people were returning to try the project again. Some recorded videos, and others brought their friends over to try it. Everyone who interacted with my installation had a smile on their face and, in some cases, let out a laugh. That kind of genuine laughter, curiosity, and repeat enjoyment was extremely validating of my goals and hard work. The system wasn't just interactive, it was collaborative. It gave participants a sense of control, feedback, and discovery. Each person interacted with my project differently, and the structure stayed intact. This balance of consistency and flexibility was something I was aiming for from the beginning.

Final Reflections

Before this project, I had never worked with Python or Processing. Most of my coding experience came from JavaScript and browser environments like p5.js. I took this on knowing it would be a challenge, and it absolutely was. Python's syntax tripped me up constantly in the beginning, especially with indentation errors that would prevent my script from running altogether. It was frustrating, but it taught me to slow down, stay patient, and problem-solve carefully. More than anything, this project pushed me out of my comfort zone. Most of my past work has been in fixed formats such as video art, short films, and edited sequences meant to be watched, not interacted with. My Film/Video Production minor also shaped this approach, focusing on work made for passive viewing. This piece was completely different; it was interactive, live, and unpredictable. At first, the thought of people interacting with it made me nervous. What if the system broke? What if someone got confused or gave up? Would I need to stand next to my installation the entire time? But once the show opened, I felt a sense of calmness. The system never broke or had to be restarted; people laughed, engaged, and kept coming back. I could walk away and still hear it triggering from across the gallery, followed by distant giggles and reactions from new participants. That feeling of the work living on its own, with people actively shaping it, was incredibly rewarding.

If I had more time, I would have revisited a few core elements. I would have tried solving the hand distance scaling again. I also would have continued troubleshooting the Processing error of the original visual system to keep the ripples and particles. I'm also interested in experimenting with generative audio rather than just triggering preloaded files. One reason I used preloaded files was to ensure everything stayed within a musical scale; it kept the experience cohesive and respectful of the shared gallery space. But I'd like to explore giving users more control over pitch and rhythm, allowing them to shape the sound in more expressive ways. I'd also expand on the detection system to support more emotions and gestures.

This project strongly confirmed the ideas I explored in my research. Concepts like co-creation, embodied interaction, and audience agency weren't just abstract theories, they played out in real-time as viewers shaped the system's output. No two interactions were exactly alike, yet the system maintained a structure that made people feel guided rather than confused. Looking forward, I'm excited to keep building interactive works that encourage exploration. This experience also made me think about how I might merge my interest in video art with responsive systems. Additionally, I want to continue developing procedural systems that produce unique outcomes. In many ways, this was just a first step, one I'll never forget.

Documentation of my project can be viewed here:

https://youtu.be/Dsu4dzcI4XU?si=P3sfX4ZbXk7Gi96v

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