# Embodied Responses to Posthuman Performance: A Mixed-Methods Study of Physiological and Emotional Audience Reactions


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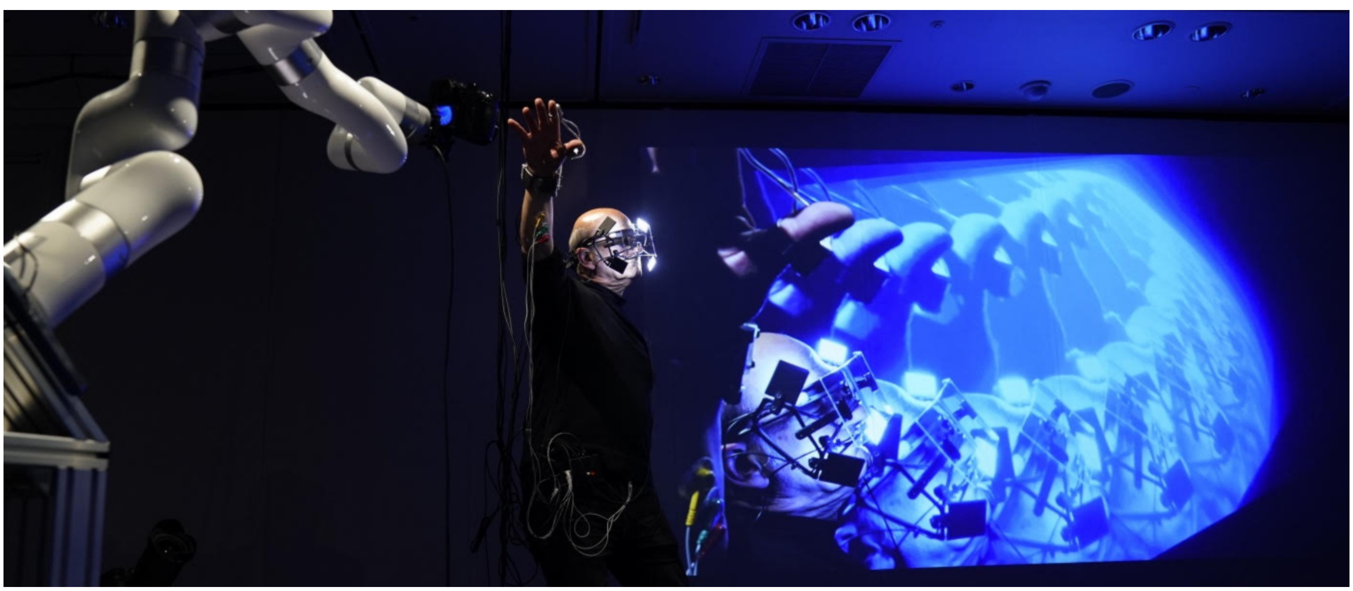

**Figure 1: In the performance by the artist, audience members' physiological signals were recorded and integrated into the performance. The camera on the robotic arm was controlled by the artist's muscle activity and breath, turning his body into a live audio-visual mixer. Data from PPG, EDA, and inertial measurement unit (IMU) sensors revealed a rich interplay between audience members' bodily reactions and their later emotional reflections. (© 2024 Hiroyasu Daido, used with permission)**

## Abstract

We present a mixed-methods study examining audience responses to a live posthuman performance featuring real-time biometric feedback integration. Twenty-three participants wore physiological sensors (photoplethysmography [PPG], electrodermal activity [EDA], accelerometer) during a 50-minute performance while completing emotional assessments (PANAS). Nine participants provided qualitative insights through interviews. Physiological analysis showed exploratory patterns in heart rate variability over time, with preliminary evidence suggesting that higher baseline electrodermal activity associates with reduced negative affect ($r = -0.535$, $p = 0.049$). Movement energy showed positive correlation with improved affect ($r = 0.426$, $p = 0.043$). Both don't survive false discovery rate correction. Qualitative analysis identified themes including embodied engagement amid conceptual confusion and technological alienation. Three key findings emerged: performance structure affects physiological data quality, ambiguous art elicits delayed reflection, and higher initial excitement provides protective emotional effects through sustained baseline arousal. The findings reveal a complex disconnect between physiological arousal and cognitive meaning-making processes. We contribute a methodological framework for studying audience responses to ambiguous performance art, demonstrating how embodied reactions operate independently from conceptual comprehension in posthuman aesthetic experiences.

## CCS Concepts

• **Human-centered computing** → **Human computer interaction (HCI)**; *Human computer interaction (HCI)*; Interaction design; • **Applied computing** → *Arts and humanities.*

## Keywords

posthuman performance, physiological sensing, audience response, mixed-methods, embodied interaction, performance art, HRV, EDA, PANAS

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## 1 Introduction

Performance artists often seek to create experiences that promote reactions, engaging the audience at a conceptual but also emotional level through the utilization of subtle expressive means, including physical actions, sounds, and imagery [27]. Albeit no formal unified definition of performance art exists, the idea of utilizing the body as a tool for conveying meaning and emotion, the absence of linear narrative structures, and the blurring of boundaries between artists and spectators are key elements of the genre [2, 14, 19]. While often striking in its nature, resulting in its ability to evoke strong emotions, performance art can be difficult to understand for those without training, which can lead to lower interest and appreciation [13, 31]. Aesthetic appraisal theories suggest that such phenomena arise from a mismatch between the perceived complexity of an artistic performance and the spectator's self-assessed understanding of it [34, 47, 48]. Effectively, for spectators, there can be a sense of dissonance between their physiological reaction to the performance, the instinctive emotional response, and the higher-level elaboration of its perceived conceptual meaning. Subjectively, it is extremely challenging to articulate these conflicting aspects, as it requires awareness of both unconscious and conscious processes.

In both the HCI and Ubicomp fields, extensive efforts have been made to monitor subjective and objective reactions of audiences during live performances, including traditional dance, theater, and performance art [3, 22, 32, 51, 56, 60, 62]. Approaches from existing studies range from leveraging multi-sensory biofeedback based on physiological data to boost engagement and improve synchrony among audience members or with the performer [22, 25, 37], harnessing bio-signals or explicit feedback to support new creative expressions [28, 39, 63], or simply attempting to establish links between bio-data and psychometric questionnaires to assess audience responses in various live art contexts [3, 24, 32, 60, 62]. However, there is still limited research focusing on unpacking the complex relationship between self-reported experiences and embodied physiological reactions in contexts where the artistic performance is purposefully ambiguous and not explicitly created to be pleasantly engaging, but rather developed with the goal of arousing potentially confusing embodied reactions.

However, most existing HCI research with physiological signals in performance contexts focuses on traditional theatrical presentations, musical concerts, dance performances, and other conventional art forms, aiming to enhance audience engagement, synchrony, and appreciation through multi-sensory biofeedback systems and feedback loops [4, 22, 25, 37, 57]. In contrast, this work examines deliberately ambiguous and potentially alienating performance art, investigating the disconnect between physiological arousal and cognitive meaning-making processes rather than optimizing for positive audience experience. Such posthuman performance contexts offer unique opportunities to study these complex embodied-cognitive tensions.

To explore these phenomena, we present a research study that seeks to examine the interplay between physiological signals, emotional responses, and later reflections of audience members from a live posthuman art performance delivered by an internationally renowned artist. We argue that posthuman performance art makes for an apt setting to explore the unclear connection between immediate embodied reactions and post-performance reflections using a combination of objective technology-mediated sensing strategies and self-reflective human mechanisms, as it broadly aligns with the goals of the genre itself. Posthuman performance art focuses on the embodied experiences of being a human in a world where technology is deeply intertwined with our physical and emotional selves [8, 40]. This synergy creates a sense of continuum that does not


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disrupt the artistic goal of the performer and is attuned to the subsequent reflections of the audience [8, 53]. In turn, this aligns with broader recommendations of limiting disruptions when embedding research into artistic practice [6].

The artist's performance featured the body of the artist as a living video switcher and audio manipulator, where sound and video effects were created in response to minimal movements, muscle contractions, breathing changes, and heart rate variability, all collected using wearable sensors. During a live showing in Tokyo in early 2024, we collected physiological signals using PPG, EDA, and IMU sensors and emotional reactions using the PANAS scale from 23 members of the audience. Data on subjective experiences were supplemented by semi-structured interviews with a subset of 9 individuals, carried out by the authors in the week following the performance. The results show matching patterns between the progressive decrease in parasympathetic activity occurring over time, with a growing sense of confusion that emerges from the initial fascination when participants find themselves unable to decode the underlying connections between the actions of the artist and the technological sound and video effects. At the same time, individuals exhibiting higher initial sympathetic activity felt less alienated by the stream of multi-sensory information received during the performance and reported decreased negative affect, hinting at the potential coping role of early arousal. Finally, interpersonal heterogeneity in physiological and emotional responses aligned with the essential role that professional backgrounds and interpretive strategies played in individual degrees of appreciation in such an ambiguous performance.

The contributions of this work include:

We present a mixed-methods dataset combining physiological signals (PPG, EDA, IMU) and emotional assessments (PANAS) from 23 audience members during a live posthuman performance featuring real-time biometric feedback integration.

We provide a methodological framework for studying audience responses to ambiguous performance art that systematically bridges quantitative physiological analysis with qualitative interview insights to examine embodied reactions versus conceptual meaning-making processes.

We provide anonymized raw physiological data and analysis scripts to support reproducibility and future research. The complete dataset will be made available upon publication at the Open Science Framework (OSF). The complete dataset is anonymized and available under this link. Sample analysis scripts are included in the supplementary materials.

## 2 Related Work

### 2.1 Posthuman Performance and Cyborg Bodies

Contemporary performance art increasingly explores the boundaries between human and technological systems [10, 16, 42]. In particular, Posthuman Art moves beyond human-centric views that separate us from machines and non-human beings, emphasizing the hybrid interconnected nature that shapes our current realities [8, 40, 50]. A key concept in posthuman performance art is the cyborg proposed by Donna Haraway in 1985 as metaphorical being that rejects the notion of humans as "pure and natural" in favor of constructed fluid identities shaped by the continuous interactions with technology and the sociopolitical context in which they are placed [23].

In posthuman performance art, the cyborg is often embodied by explicit or implicit integrations between technologies, the body of the artist, and in some cases, the audience [20, 33, 42, 52]. Of particular interest are cases in which real-time sensing and feedback systems visualize, sonify, or actuate different physiological signals to externalize aspects of the human body that otherwise are hard to perceive [21, 30, 52]. Research in this domain has investigated various approaches to creating technology-mediated performance experiences. These interventions align with broader discussions in HCI about the shift toward arts-based research methodologies [29] and performance-led research approaches [6].

While leveraging both artist and audience data to increase interactivity and enhance synchrony is important, these strategies aim to promote greater engagement and appreciation. However, what is less understood is how to decode the connections between embodied reactions and emotional responses of audiences. This becomes especially complex in posthuman art performances, where ambiguity and dissonance are intentionally created as part of the artistic materialization of the cyborg body. In the following section, we explore the qualitative and quantitative approaches that HCI researchers use to evaluate spectator responses in live performance settings.

### 2.2 Understanding Physiological Reactions and Aesthetic Experiences of Audiences in Live Performances

Measuring audience responses to live performances has become an increasingly important research area, with studies employing various physiological sensing approaches to understand aesthetic experiences. Research has demonstrated the feasibility of using wearable sensing to analyze and predict live performance experiences [18], while other work has explored how body movements can reveal audience responses to contemporary dance [56]. Studies of audience entrainment during live performances have revealed complex relationships between physiological measures and subjective experience [4], with research showing how movement synchrony among performers can predict aesthetic appreciation [58].

Heart rate and electrodermal activity (EDA) are valuable for measuring audience engagement. Studies have shown that live music performances elicit distinct physiological responses compared to recorded music [55], with research demonstrating how live performances specifically move the human heart [44]. Electrodermal activity (EDA) has been used to predict audience responses to media content [46], while narrative engagement research has revealed how physiological signals reflect cognitive and emotional processing [41]. Comprehensive reviews of emotion recognition using physiological signals provide frameworks for understanding these responses [7, 45].

Subjective emotional and aesthetic responses, however, are assessed by a combination of standardized questionnaires, and purposefully designed questionnaires or interviews conducted after the end of a performance [1, 3, 24, 49, 59, 60]. Such methodologies rely on individual recollections and, especially in the context of qualitative interviews, are harder to deploy on a large scale.

However, they offer critical information concerning the complexity of the experience and are used to determine how spectators interpret and evaluate a live artistic performance [1, 38, 59]. Yet, there is still a limited understanding of the connection between physiological responses and subjective evaluations of audiences' emotional and aesthetic experiences. Especially in cases of posthuman performances, which are purposefully ambiguous and geared to evoke conflicting embodied reactions and subjective aesthetic emotions. Our study aims to address this gap by combining insights from physiological data, quantitative questionnaire, and qualitative accounts collected from the audience of an artistic performance.

## 3 Experimental Setup

To evaluate the performance, we employed a multi-method approach combining quantitative and qualitative measures. We collected data through questionnaires, physiological recordings, and semi-structured interviews with both audience members and the artist. This triangulation of methods was designed to strengthen the validity and depth of our findings by capturing diverse perspectives and cross-validating results across different data sources.

### 3.1 Performance Context

The physiological data for this study were collected during a live performance on February 18, 2024, at a contemporary art venue. The performance lasted approximately 50 minutes and featured the artist's characteristic integration of body modification technologies, sound art, and real-time feedback systems. The overall system architecture, illustrating the flow of data and signals from the artist to the performance audio-visual output, is detailed in Figure 2.

The performance was controlled exclusively by the artist's own physiological signals, which were transformed into a dynamic audio-visual experience through technological augmentation of the body. Audience physiological data was recorded solely for research purposes and did not influence or control any aspect of the performance in real-time. At the artist's request, no physiological data from the performer was recorded during this study.

The performance setup included a multi-camera system creating visual resonance through video feedback loops, with live control of visual perspectives ensuring the cyborg body could never be perceived from a single standpoint.

The artist's physiological signals (electrocardiogram [ECG], electromyogram [EMG], breath sensors) controlled real-time audio-visual feedback through synthesized sounds and body movements, enabling the artist's body to function as a live video switcher and audio mixer. A robotic arm provided additional visual perspectives under the artist's control.

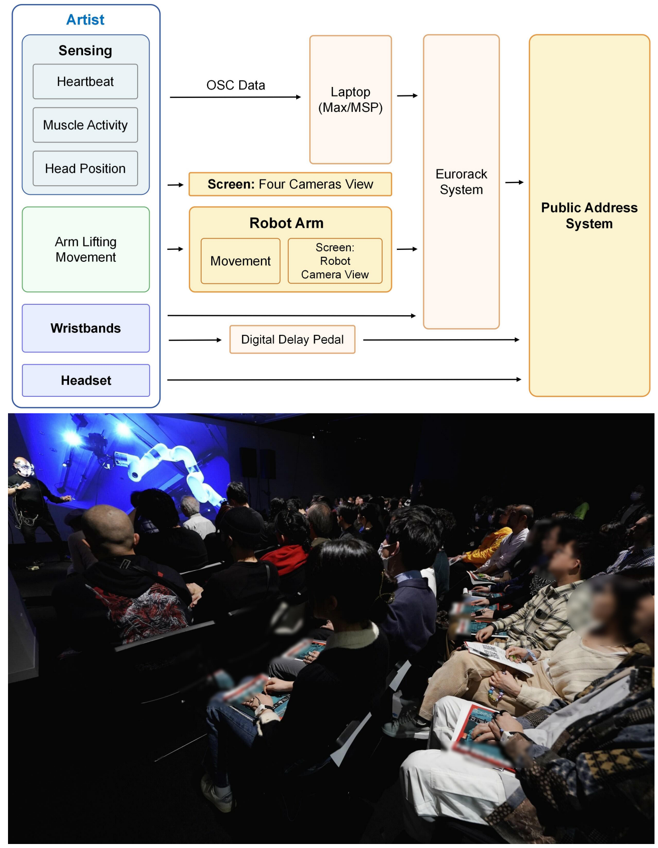



**Figure 2: (a) System architecture of the performance showing the flow of control and signal pathways from the artist's physiological sensing inputs to audio-visual outputs. (b) Live performance view showing the artist with a robotic arm and audience members wearing physiological sensors.**

### 3.2 Procedure

Participants were directed to designated seats upon arrival at the venue. Approximately thirty minutes prior to the performance, researchers initiated the informed consent and instruction process with each participant. After filling out the consent form, participants completed a pre-performance questionnaire. Subsequently, researchers fitted wrist-mounted physiological sensors on each participant's non-dominant hand. Sensor placement was carefully adjusted to minimize interference with natural movements while ensuring optimal signal quality. Participants were instructed to keep the sensor-wearing hand relatively stable throughout the performance to reduce motion artifacts, while normal postural adjustments remained permissible. During the fifty-minute performance, researchers unobtrusively monitored sensor functionality. After the performance concluded, participants completed a post-performance questionnaire before leaving the venue. In addition, nine participants volunteered for extended semi-structured interviews conducted within one week of the performance, offering deeper qualitative insights into their subjective experiences.

### 3.3 Participants

A total of 23 audience members participated in the study by completing questionnaires and wearing physiological sensors during the performance. Both pre-performance and post-performance questionnaires were completed by all 23 participants (13 males, 9 females, 1 non-binary) aged between 20 and 44 years (M = 29.4, SD = 6.0). For the analysis of the physiological data, some participant data were excluded due to low signal quality and consistency. After exclusion, we analyzed the following number of data sets: 14 for EDA analysis, 23 for HRV analysis, and 23 for accelerometer analysis. Mixed-methods integration analyses linking physiological and qualitative data were limited to the 14 participants with complete EDA data. After being introduced to the system, all participants provided informed consent for physiological monitoring. The experimental setup and data collection were conducted according to institutional ethics guidelines.

## 3.4 Questionnaire Assessment

Pre- and post-performance questionnaires assessed emotional states using the Positive and Negative Affect Schedule (PANAS). The PANAS is well established in the HCI community and consists of 20 items measuring positive affect (PA) and negative affect (NA) on 5-point Likert scales. Questionnaires were administered:

- **Pre-performance:** 15 minutes before the scheduled start time
- **Post-performance:** Immediately following the performance conclusion

Change scores were calculated as post-performance minus pre-performance values to assess emotional shifts induced by the performance experience.

## 3.5 Physiological Sensing System

Participants wore wrist-mounted physiological sensors throughout the performance. The devices recorded electrodermal activity (EDA) sampled at 10 Hz using dry electrodes to capture sympathetic nervous system arousal, blood volume pulse (BVP) sampled at 200 Hz using photoplethysmography with infrared LED illumination for heart rate variability analysis, and 3-axis accelerometer data sampled at 50 Hz (±8g range) to detect movement patterns and filter motion artifacts. All signals were digitized using 12-bit analog-to-digital conversion with anti-aliasing filtering.

Each device was labeled with a unique ID that participants recorded on their questionnaires for data matching. Participants were instructed to wear the device on their non-dominant wrist with secure but comfortable strap tension to ensure proper sensor contact while minimizing excessive movement during the performance. Environmental conditions (temperature 22°C, humidity 45%) were stable throughout data collection.

## 3.6 Semi-Structured Interviews Audience Members

From the post-performance questionnaire respondents, nine participants volunteered for in-depth semi-structured interviews. Each interview lasted approximately 45 minutes and was carried out in person or on video call according to participants' preferences. These interviews explored how audience members experienced the tension between instinctive physiological reactions and cognitive interpretation in response to deliberately ambiguous performance art. This qualitative insight complements our physiological data by highlighting how viewers make sense of confusion in artistic contexts. All interviews were audio recorded with the consent of participants and transcribed verbatim for the analysis. A copy of the interview guide is included as supplementary material.

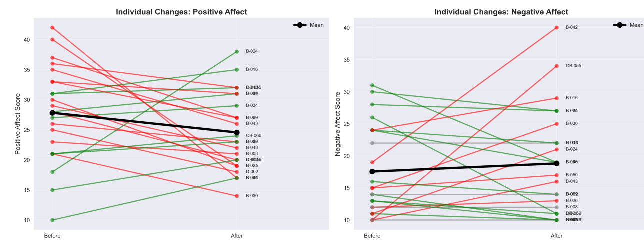



**Figure 3: Individual changes in positive and negative affect scores from pre- to post-performance. Each colored line represents one participant's trajectory, with the thick black line showing group means. The left panel shows positive affect changes (mean decrease from 27.4 to 24.7), the right panel shows negative affect changes (mean decrease from 18.1 to 18.8).**

## 3.7 Semi-Structured Interview Artist Intention

To explore the conceptual basis of the performance, we conducted a semi-structured interview with the artist. The interview was carried out online using a videoconferencing platform and lasted approximately 1 hour and 20 minutes. This offered insight into his intentions, particularly his use of technological mediation and deliberate ambiguity. The artist's perspective helped contextualize the design choices behind the work. The interview was recorded with the consent of the artist and transcribed verbatim for analysis. The copy of the interview guide is included in the supplementary materials.

# 4 PANAS Emotional Response Analysis

Prior to examining physiological correlations, we analyzed the emotional impact of the performance using PANAS scores to understand the overall affective responses and individual variation patterns.

## 4.1 Individual Emotional Changes

Figure 3 displays individual participant trajectories for positive and negative affect from pre- to post-performance, revealing substantial heterogeneity in emotional responses to the artistic experience.

The analysis revealed distinct patterns of emotional transformation:

**Positive Affect Patterns**: Most participants (17 of 23) experienced reductions in positive affect, with the group mean declining from 27.4 to 24.7 (mean change: -2.7 points). Individual variation ranged from substantial increases (+18 points) to marked decreases (-15 points).

**Negative Affect Patterns**: Negative affect changes showed greater individual heterogeneity with minimal overall group change (18.1 to 18.8, mean change: +0.7 points). Participants displayed divergent responses ranging from +28 to -18 points, suggesting the performance elicited polarized emotional responses.

# 5 Physiological Data Analysis

We conducted comprehensive analyses of multi-modal physiological signals collected during the performance, including electrodermal activity (EDA), heart rate variability (HRV), and accelerometer

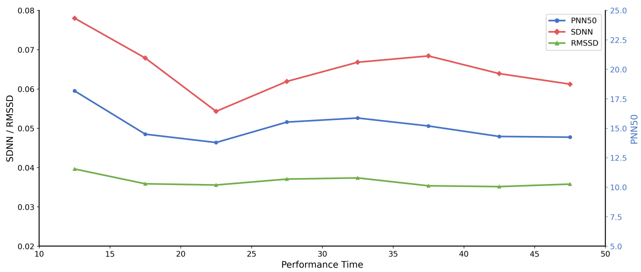



**Figure 4: Temporal evolution of heart rate variability metrics during the performance. PNN50 (blue circles, right y-axis) represents parasympathetic activity; SDNN (red diamonds) and RMSSD (green triangles) on the left y-axis represent overall HRV and short-term variability, respectively. Data shows group means across 23 participants.**

data. Each participant wore wrist-based sensors that continuously recorded these signals throughout the entire performance duration. Pre- and post-performance PANAS (Positive and Negative Affect Schedule) questionnaires were used to assess emotional changes, allowing us to correlate physiological responses with subjective emotional outcomes.

## 5.1 Heart Rate Analysis

Heart rate analysis encompasses both temporal patterns and correlations with emotional outcomes. We extracted HRV metrics from the blood volume pulse (BVP) signal sampled at 200 Hz using a multi-library validation approach.

*5.1.1 Signal Processing Pipeline.* Raw BVP signals underwent preprocessing with a multi-library validation approach for robust peak detection. Peak detection employed physiological constraints (heart rate [HR]: 40-200 bpm, R-R intervals: 300-2000 ms) with automated artifact removal using concurrent accelerometer data for motion screening. Signal quality assessment achieved 98.6% validation success across analysis windows.

For temporal evolution analysis, we applied 5-minute non-overlapping windows across the 10-60 minute performance period, generating approximately 9 windows per participant. Feature extraction included time-domain metrics (standard deviation of NN intervals [SDNN], where NN denotes normal-to-normal intervals between successive heartbeats after artifact removal; root mean square of successive differences [RMSSD]; percentage of adjacent NN intervals differing by >50ms [pNN50]), frequency-domain features via Welch's method (LF power, HF power, LF/HF ratio), and nonlinear measures including Poincaré plot parameters (SD1, SD2) and sample entropy for complexity assessment.

*5.1.2 Temporal Evolution of HRV Metrics.* Figure 4 presents the temporal evolution of three complementary HRV metrics throughout the 40-minute performance period, aggregated across participants (n=23). The metrics capture different aspects of cardiac autonomic regulation:

**PNN50** (percentage of successive NN intervals differing by >50ms) declined progressively from 16.3% in the early phase (10-20 minutes) to 14.6% in the late phase (35-50 minutes), indicating reduced parasympathetic nervous system activity as the performance progressed.

**RMSSD** (root mean square of successive differences) showed a similar declining trend, decreasing from 37.8ms to 35.4ms, further confirming the gradual reduction in short-term heart rate variability associated with parasympathetic withdrawal.

**SDNN** (standard deviation of NN intervals) exhibited a different pattern, with an initial decline from 72.9ms in the early phase to 61.0ms in the middle phase (20-35 minutes), followed by partial recovery to 64.5ms in the late phase. This metric reflects overall HRV incorporating both sympathetic and parasympathetic influences.

*5.1.3 Interpretation.* The observed temporal HRV patterns may suggest a complex autonomic response to the performance experience, though these preliminary observations require cautious interpretation. The apparent decline in parasympathetic indicators (PNN50, RMSSD) throughout the performance could indicate increasing physiological arousal as audiences engaged with the artistic content, though individual differences in HRV baseline and reactivity may contribute to these patterns.

The SDNN pattern, which appears to show middle-phase suppression followed by partial recovery, could potentially reflect adaptive autonomic regulation as participants initially responded to the performance's intensity before developing some accommodation to the stimuli. However, this interpretation remains speculative and would require replication with larger samples to establish reliability.

## 5.2 Electrodermal Activity Analysis

Electrodermal activity (EDA) reflects sympathetic nervous system arousal through skin conductance changes. We analyzed both tonic (slow-changing baseline) and phasic (rapid response) components of the EDA signal sampled at 10 Hz.

*5.2.1 Signal Processing and Quality Assessment.* EDA signals underwent a multi-stage preprocessing pipeline including extreme outlier removal (4-$\sigma$ threshold), low-pass filtering (1.0 Hz cutoff), artifact detection and interpolation, and physiological range enforcement (0.01-100 $\mu$S). Tonic and phasic components were separated using frequency-domain filtering: high-pass (>0.1 Hz) for phasic responses and low-pass (<0.5 Hz) for tonic baselines.

Participants were categorized by signal quality using automated metrics: signal-to-noise ratio (SNR > 20 dB), artifact percentage (<15%), and physiological plausibility checks. Quality categories included high quality (n=11), moderate quality (n=3), and excluded (n=9). Final analysis included 14 participants with usable EDA data, representing 61% of the original sample. Feature extraction employed 60-second windows with 50% overlap across the 10-60 minute performance segment to balance temporal resolution with signal stability for skin conductance response (SCR) detection.

*5.2.2 EDA-Emotion Correlations.* Analysis of EDA metrics revealed an exploratory correlation with emotional outcomes. Figure 6(a) shows the relationship between mean skin conductance level (SCL) and negative affect changes.

An exploratory negative correlation was observed between mean skin conductance level and negative affect change ($r = -0.535$, $p = 0.049$), though this did not survive Benjamini-Hochberg FDR correction for multiple comparisons:

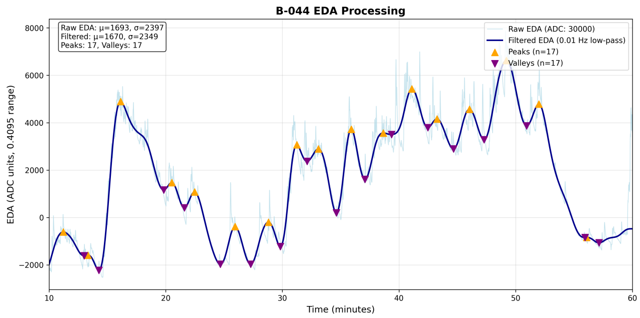



**Figure 5: Example EDA signal processing for a representative participant during the performance. The raw EDA data from 12-bit analog-to-digital converter (ADC) is depicted in light blue. The low-pass filtered data is depicted in blue. Orange markers depict recognized peaks in skin conductivity (local maxima); purple markers depict recognized valleys (local minima). The plot demonstrates the signal processing pipeline from raw sensor data to feature extraction, showing 14 peaks and 15 valleys detected across the 60-minute recording period.**

**SCL-Negative Affect Association**: This preliminary finding suggests that participants with higher baseline electrodermal activity may have experienced greater reductions in negative affect following the performance. While requiring replication, this pattern could indicate that higher sympathetic nervous system activation serves a protective function during challenging aesthetic experiences.

It seems participants showing higher baseline arousal are better able to process potentially disturbing performance aspects. However, this interpretation remains tentative given the small sample size (n=14) and lack of statistical significance after FDR correction, representing a preliminary observation requiring validation in larger samples.

## 5.3 Accelerometer Analysis

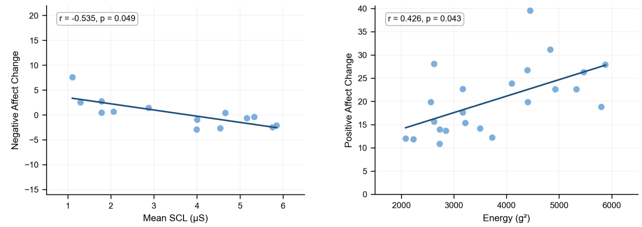
We analyzed wrist-worn accelerometer data (50 Hz, 3-axis) to measure audience movement during the performance. After filtering out gravity, we extracted 15 movement features from 1-minute sliding windows with 50% overlap: energy, magnitude statistics, jerk, variability, and inactivity patterns.

Movement energy quantifies cumulative activity:

$$\text{Energy} = \sum_{i=1}^{n} (a_x^2 + a_y^2 + a_z^2) \tag{1}$$

where acceleration is measured after gravity removal, and $n = 3,000$ samples per 60-second window. Energy values ranged from 1,780-6,531, matching normal fidgeting and posture shifts for seated viewers.

*5.3.1 Movement-Emotion Correlations.* One correlation emerged: higher movement energy associated with larger gains in positive affect (r = 0.426, p = 0.043, Figure 6(b)). This fits prior work linking positive emotions to motor activity—engaged viewers fidget and gesture more.




EDA-Negative Affect Movement-Positive Affect

**Figure 6: Exploratory correlations between physiological measures and emotional changes. (a) Mean SCL correlates negatively with negative affect change (r = -0.535, p = 0.049), suggesting that higher baseline skin conductance associates with reduced negative emotions. (b) Movement energy correlates positively with positive affect change (r = 0.426, p = 0.043), indicating vigorous movement associates with enhanced positive emotions. Neither correlation survived Benjamini-Hochberg FDR correction for multiple comparisons.**

However, this didn't survive Benjamini-Hochberg FDR correction ($\alpha = 0.05$). Given our sample size (n=23), we consider this exploratory. Still, it suggests embodied engagement may involve kinesthetic activation, not just passive observation.

# 6 Qualitative Analysis of Audience Experiences

## 6.1 Methodology

We employed an inductive thematic analysis approach following Braun and Clarke's framework on nine interview transcripts (duration: 15-45 minutes each) [9]. Participants included individuals with diverse professional backgrounds: amateur musicians, software developers, digital artists, media design students, and architects. The sample included both English (n=3) and Chinese (n=6) speakers to capture cultural variation in interpretation.

The analysis process involved: (1) data familiarization through multiple readings, (2) initial coding of salient features across the dataset, (3) theme development through iterative refinement, (4) theme validation through supporting quotes from multiple participants, and (5) cross-case comparison by participant backgrounds and cultural contexts.

## 6.2 Major Themes

Three major themes were conceptualized from our analytical process: Embodied Engagement Amid Conceptual Confusion, Temporal Dynamics of Engagement, and Technological Alienation vs Technological Fascination.

*6.2.1 Embodied Engagement Amid Conceptual Confusion.* Participants experienced a fundamental dissonance between their bodily involvement and cognitive understanding, exemplifying the gap between physiological reaction and conceptual meaning-making that characterizes responses to purposefully ambiguous art. Despite mounting interpretive confusion, audiences maintained sustained engagement, suggesting that embodied reactions operate independently from conceptual comprehension:

> *"I was really captivated in the first 10 minutes...I was trying to connect like what caused, what was the connection, and then what is the meaning"* (Digital Artist)

The sustained autonomic arousal we measured—declining parasympathetic activity throughout the performance—directly corresponds to this embodied engagement that persists despite conceptual confusion, demonstrating how physiological responses can remain elevated even when higher-level meaning-making fails.

*6.2.2 Temporal Dynamics of Engagement.* Most participants described initial fascination that gradually waned, a pattern that corresponds with our HRV measurements showing progressive parasympathetic withdrawal:

> *"I felt disengaged after 10 minutes or so...it was too long for me, really too long"* (digital artist)

These accounts help interpret our physiological data: sustained autonomic arousal likely reflected the effort required to maintain attention rather than genuine fascination. The lack of a defined starting point and "narrative arc" created a compounding negative effect, with participants experiencing progressive disconnection and confusion about the artist's intended message.

This negative feedback loop resonates with the EDA data showing that individuals exhibiting lower arousal at the start of the performance were more likely to feel progressively more confused and alienated as they struggled to make sense of the experience.

*6.2.3 Technological Alienation vs Technological Fascination.* Qualitative accounts of performance experience were somehow split in their evaluation between those who found the performance compelling and those who found it alienating. Such a pattern seemed to follow the divisive patterns observed in the PANAS responses. When exploring the potential causes for such a discrepancy, it appears that the value attributed to the overpowering presence of technology played an important role.

For some participants, the perceived dominance of artist-machine interaction over artist-audience connection created feelings of exclusion, with the artist's movements seeming "artificial" and "alien." Others, especially those reporting higher positive affect, were fascinated by the human-machine fusion and appreciated specific technological effects like visual transformations.

> *"I was very moved when he said 'The body is nobody'...his fusion with machines made me feel very touched"* (media design student)

Such dichotomy of positive vs negative interpretations matches the reported emotional variability mediated by one's interest or distrust of technology. Our EDA findings gain context here: participants with higher baseline arousal who were not alienated by the posthuman context showed reduced negative affect, suggesting sustained sympathetic activation helped them process challenging content without becoming emotionally overwhelmed.

## 6.3 Integration with Physiological Findings

The convergence between physiological measures and interview themes validates our mixed-methods approach and reveals the complex interplay between embodied responses and cognitive interpretation. The progressive decline in parasympathetic activity (PNN50: 16.3% to 14.6%, RMSSD: 37.8ms to 35.4ms) directly parallels participants' descriptions of sustained cognitive effort: *"I was trying to connect like what caused, what was the connection, and then what is the meaning"* (Digital Artist). This convergence suggests that prolonged interpretive work during ambiguous performances manifests as measurable autonomic changes reflecting sustained attention and cognitive load.

The exploratory EDA-negative affect correlation gains interpretive depth through qualitative accounts of technological engagement. Participants with higher baseline skin conductance who described fascination with *"human-machine fusion"* demonstrated potential protective effects of sympathetic activation during challenging aesthetic encounters. This integration reveals how individual differences in physiological reactivity may influence the capacity for aesthetic appreciation in technology-mediated performance contexts, though these exploratory findings require validation in larger samples.

# 7 Artistic Intention versus Audience Reception

To understand why physiological responses and emotional outcomes varied so widely, we interviewed the artist alongside the audience members. This comparison reveals how the artist's deliberate creation of ambiguous, post-human performance experiences generates the very physiological-conceptual dissonance that characterizes audience responses to challenging contemporary art.

## 7.1 The Artist's Conceptual Framework

The artist described a philosophical vision of post-human embodiment, viewing the body as "a component of a more extended operational system of computers, robots, cameras and the video projector." This framework rejects traditional ideas about human agency. The artist spoke of performing "in a posture of indifference," letting technological mediation guide the experience rather than making predetermined choices.

The artist deliberately avoided conventional performance expectations, describing the sounds as "signals" rather than music and putting conceptual integrity ahead of audience accessibility. This intentional ambiguity was designed to generate physiological-conceptual tension—bodies remained engaged while minds struggled with meaning-making.

## 7.2 Divergent Perspectives

Comparing artist and audience perspectives reveals fundamentally different approaches to meaning-making in technology-mediated performance. The artist worked within a post-human framework where "the body is nobody," but audiences used familiar cultural categories to understand what they saw. Participants approached the performance through various lenses-some attempting to reverse-engineer the system's logic, others focusing on interaction design principles, and many searching for familiar patterns the artist had intentionally avoided.

The performance's length highlighted this gap. The artist saw the hour-long duration as necessary for exploring different technological states. Audiences found it repetitive and exhausting. This mismatch points to deeper differences in how artists and audiences approach time in technology-mediated performance.

Most tellingly, the biometric feedback system remained invisible to audiences, who felt disconnected from their own physiological contribution despite its integration into the performance. This created interpretive tension between the artist's post-human vision and the audience's need for legible connection to their embodied participation.

## 7.3 Implications for Embodied Performance

Technological sophistication alone cannot guarantee meaningful audience engagement. The artist successfully created a complex human-machine symbiosis, but audiences experienced confusion and isolation. The performance catalyzed individual meaning-making rather than transmitting philosophical concepts. Embodied interactive performances need to consider the audience's phenomenological experience alongside technical capability, especially when bridging the gap between technological mediation and felt agency.

# 8 Discussion

We discuss how performance characteristics influence physiological measurement suitability, focusing on narrative structure, conceptual framing, and audience expectations.

## 8.1 Performance Structure Affects Physiological Data Quality

Traditional performances (music, theater, dance) follow narrative structures with emotional peaks and valleys that generate measurable physiological changes. Prior work demonstrates physiological synchrony in live music audiences [11, 36, 57], performer-audience connection in dance [15, 54], and actor synchrony in theater [61].

However, in performance art, the absence of dramatic changes may be deliberate. One participant noted: *"the moment he was controlling the camera for the first time...really activated my curiosity" (P1)*. Researchers should consider that performances without clear emotional arcs may not produce the physiological extremes suited for standard time-series analysis.

## 8.2 Ambiguous Performances Elicit Delayed Reflection

The artist's posthuman performance was purposefully ambiguous, prioritizing conceptual coherence over accessibility. Unlike traditional performances that provoke immediate emotional reactions, conceptually complex works encourage delayed reflection. As P1 noted: "It activated my curiosity more so than anything else."

Our physiological data support this interpretation: we observed no significant fluctuations in heart rate or EDA during the 50-minute performance. This highlights a limitation of real-time physiological metrics for performances without conventional emotional arcs. Alternative methods—post-performance interviews, surveys, or longitudinal observation—may better capture reflective processes that emerge over time.

## 8.3 Initial Excitement and Electrodermal Activity

Participants with higher excitement and expectations maintained elevated baseline EDA throughout the experience, helping explain the negative correlation ($r = -0.535$, $p = 0.049$) between mean skin conductance and negative affect change. Those who arrived with greater anticipation showed sustained higher EDA levels rather than discrete arousal peaks.

This suggests that audience expectation translates into stable, elevated physiological engagement that may enhance emotional resilience during challenging artistic encounters.

## 8.4 Implications for HCI Design

These design implications emerge primarily from our qualitative analysis of nine participant interviews. While physiological data provide suggestive contextual evidence of embodied engagement patterns, the following recommendations stand on the evidential foundation of rich experiential accounts. We situate these implications within established HCI frameworks for experience design [35] and embodied interaction [12], while acknowledging that our findings derive from a specific performance art context.

*8.4.1 From Embodied Engagement Amid Conceptual Confusion.* **Implication 1: Scaffold Meaning-Making Without Eliminating Ambiguity.** Multiple participants reported sustained engagement despite substantial conceptual uncertainty. One participant (P20) described: *"I was trying to kind of guess and figure out what was going on... I don't have a clear answer. I think [explanation] would probably help mass appreciation... but I'm not sure it would lead to better engagement"*. These accounts suggest that posthuman performance interfaces should provide interpretive scaffolding that supports rather than forecloses meaning-making [17]. We recommend: (a) *layered information architecture* with optional contextual information; (b) *post-experience meaning-making resources*; and (c) *calibrated ambiguity*, distinguishing generative uncertainty from frustrating opacity.

However, P21 (digital artist) offered a contrasting perspective: *"There should have been a kind of tutorial level at the beginning where he did one action. And we see the result, stimulus response"*. This divergence suggests optimal scaffolding depends on individual differences in tolerance for ambiguity.

**Implication 2: Support Diverse Engagement Modalities.** Interviews revealed heterogeneous strategies for navigating confusion. P04 sought causal understanding, P20 oscillated between analytical and aesthetic modes, while P21 sought embodied participation: *"If I want to imagine embodiment, I have to experience it with my embodiment."*. This implies: (a) *multi-modal entry points* accommodating analytical, emotional, and embodied engagement [35]; and (b) *flexible attention structures* permitting both focused attention and peripheral awareness.

*8.4.2 From Temporal Dynamics of Engagement.* **Implication 3: Design for Attention Rhythms.** A recurring pattern was initial fascination followed by attentional waning. P21 noted: *"I was really captivated in the first 10 minutes. And after 10 minutes, I couldn't understand why it continued."*. P04 similarly felt it "got a bit repetitive." Extended posthuman performances benefit from: (a) *punctuated structure* with periodic novelty; (b) *explicit duration communication*; and (c) *legitimate exit options* without social disruption.

**Implication 4: Leverage Attention Phase Transitions.** Several participants described qualitative shifts in engagement mode.

P20 reported becoming *"more comfortable"* in the second half with *"the idea that this is not a musical performance."*. Designers might: (a) *front-load conceptual density* when curiosity is highest; and (b) *design for the normalized state* with subtler elements emerging after initial spectacle recedes.

*8.4.3 From Technological Alienation vs Fascination.* **Implication 5: Make Human-Machine Boundaries Legible.** Participants reported difficulty understanding what drove the system's behavior. P21 expressed frustration: *"I was trying to connect what caused what... To be honest, I don't know the meaning at all"*. Building on frameworks for embodied interaction [12] and somaesthetic appreciation [26], we suggest: (a) *visible technological mediation* making human-machine boundaries apparent [5]; and (b) *failure as feature*—moments of clear human-technology negotiation may enhance engagement by revealing agency.

**Implication 6: Address Alienation Through Participation.** P21 asked: *"How can I understand embodiment without doing it myself?"*. Mitigation strategies include: (a) *distributed agency markers* indicating performer versus technology control; (b) *feedback visibility*—P21 asked, *"Why don't you give me a computer monitor? So I can see my own data"*.; and (c) *audience-accessible technology* for embodied understanding through direct experience.

These recommendations should be treated as sensitizing concepts [43] rather than generalizable rules, given they derive from nine interviewed participants in a single performance context.

## 9 Conclusion

This study examined audience responses to posthuman performance art through a novel mixed-methods approach combining physiological sensing with qualitative analysis. Our investigation of a live performance by an internationally renowned artist revealed three key insights that advance understanding of embodied aesthetic experiences in contemporary art contexts. First, we demonstrated that performance structure significantly affects the quality and interpretability of physiological data. Unlike traditional performances with clear emotional arcs, posthuman art's deliberate ambiguity produces sustained rather than reactive physiological patterns, requiring different analytical approaches for meaningful interpretation. Second, ambiguous performances elicit delayed audience reflection rather than immediate measurable responses. This temporal disconnect between embodied experience and cognitive processing suggests that real-time physiological metrics may be insufficient for evaluating conceptually complex artistic works, necessitating complementary qualitative methods. Third, our analysis revealed that participants with higher initial excitement and expectations maintained elevated baseline electrodermal activity, which provided protective effects against negative emotional responses. This finding suggests that audience preparation and anticipation play crucial roles in determining aesthetic outcomes for challenging contemporary art. These insights contribute to the growing field of audience research in HCI and performance studies by providing both methodological guidance for studying ambiguous artistic experiences and empirical evidence of the complex relationship between embodied reactions and conceptual meaning-making in posthuman aesthetic encounters. Future work should explore these dynamics across diverse performance contexts and investigate how technological mediation shapes audience engagement in contemporary art.

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