Computationally Random Choreography: An Investigation into Computational Creativity and Choreographic Perception

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Dance Capstone

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Abstract

Often considered divergent disciplines, computer science and dance share limited intellectual crossover in research and literature. Where work exists, the resources are often unidirectional; dance will support or frame the computer science-driven investigation, and rarely be reversed. Under these constraints, the implications of computer science in a dance (creative) environment are not adequately covered. This study investigates the gap between *creative ambiguity* and *computational determinism*. I propose two choreographed performances and a collection of interpreted results from a **10**-person pilot study. The first performance features original choreography prepared for film, accompanied by original (non-movement-influential) music. The second performance, known as a **Computationally Random Choreography (CRC)**, was created by a Bash script with FFmpeg software to shuffle the frames of the *original* performance; code excerpts are available in the Appendix. The randomized sequence was interpreted and performed on film with another original musical accompaniment. A pilot study analyzing the interpretation and perception of both videos revealed insight into computational perception and artistic intent. Surprisingly, the randomized choreography did not hinder emotional resonance—participants often described the CRC as expressive, deliberate, and even more emotionally complex than the original. These findings suggest that randomness, when interpreted through human movement, can generate compelling artistic outcomes and challenge assumptions about authorship, creativity, and meaning in dance. Moreover, the integration of creative ambition into computer science development and education is essential, fostering interdisciplinary innovation and redefining how we perceive both artistic and computational possibility.

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Finally, I would like to thank Denise Murphy-Rohr. Her influence extends far beyond this project alone. I would like to thank Denise Murphy-Rohr for her truest, heartfelt encouragement that made me decide to become a *dance minor*. Never did I anticipate, nor would I have guessed, that I'd graduate minoring in dance; a field I have **never** participated in before college. In the Fall of 2023, Denise gave *me* a chance—a push to join a community larger than myself—and I will be forever grateful to her.

1 Introduction

Author and philanthropist Shah Asad Rizvi once wrote: 'Dance is the timeless interpretation of life.' Tangentially, theoretical computer science pioneer Alan Turing famously claimed: 'Those who can imagine anything can create the impossible.' These two quotes, from radically different disciplines, capture the essence of this project: the intersection of embodied expression and computational possibility. In 1949, Alan Turing described what he once called the *imitation game* in which an arbitrary machine capable of mimicking human responses could theoretically be indistinguishable from human conversation. This test would eventually evolve into the *Turing Test*: a benchmark for a machine's ability to exhibit intelligence. Traditionally, the *Turing Test* is limited to language; however, conversation is merely one facet of human intelligence (and, more importantly, human expression). This study frames Alan Turing's stellar exemplification of machine intelligence with Rizvi's *timeless interpretation of life* to investigate a computer's capacity to *choreograph* movement—and more crucially, to analyze how humans perceive and interpret machine-generated choreography.

In a world of rapidly expanding artificial text and knowledge distribution, linearly, it becomes increasingly difficult to differentiate between human-written text and large-language model text. In a study conducted by researchers at Penn State, participants could distinguish AI-generated text from human-written text with only 53% accuracy [1]. Frequently, a machine's choices **outpace and deceive even the humans who rely on them**, challenging their confidence in distinguishing machine-generated text from human expression. In the presenting study, participants are asked to analyze, interpret, and make sense of two choreographies: an original and a computationally randomized choreography. Following their interpretations, participants must decide which choreography was the original.

Though interpretive results are rarely quantifiable on an individual basis, a collection of authentic responses can answer the central question of this research: Can a machine's randomly generated choreography still communicate emotion, intent, or meaning to human viewers? Moreover, this process will explore how the creative practices of choreography and software development intersect. This project emerged from my dual passions for code and dance, and a desire to creatively intersect these fields in unprecedented ways. Algorithms are notoriously uncreative—they are, definitively, *algorithmic*—and this project challenges the assumption that they cannot contribute meaningfully to artistic creation.

To create an environment to answer the questions above, first, I created an original, *computer-influenced* choreography, drawing from a machine's recurring monotonous and rigid thematic assumptions. I performed this original choreography in front of four camera angles and edited the videos into a dance piece. This choreography served as an input for a Bash and FFmpeg script that extracted individual frames, shuffled, and reassembled them into a newly generated choreography. I then performed the CRC the same as the original: in front of four cardinal camera angles, with two takes per shot. The videos were edited for film and accompanied by original music to enhance their visual and emotional impact over what would otherwise be plain, static recordings.

2 Related Works and Discussion

A crucial part of this research is development – namely the early development of the initial choreography I used for manipulation. Dance choreography and dance for film are mutually exclusive – the two require different approaches. Thus, to maximize the camera's capabilities, I plan on using Hourigan's research of "strategies to achieve visual communication" via

recorded movement [2]. Hourigan fought against traditional ballet tropes to discover "eight" successful strategies for visual communication, and as a means to "inspire other choreographers to challenge existing traditions" – those choreographers, not limited to myself [2]. Hourigan's most significant findings centered on the "need to capture the emotion and or gestural movement of the dancer in close-ups or mid-shots" [2]. Effective camera maneuvers produce effective emotional communication; choreographic choices with the camera's ability in mind suggest a "less is more" strategy [2]. Although I did not employ varied shot types such as close-ups, the camera was still used intentionally to reinforce the emotional tone of the piece. All the footage was framed consistently to maintain visual coherence, but each movement was performed with the camera in mind—not to showcase the full range of motion, but to emphasize clarity, weight, and presence.

Daniel Koshland satirizes a "misbehaving computer" in his *Insubordinate Computer* [3]. Their albeit parodic interpretation of a computer's attempt to alter its own processes (against human will) opens the philosophical reasoning for a computer's reasoning. Notoriously (and scientifically) known to lack creative/critical thinking, a computer is rarely probed for its creative insight. This choreographic process challenges that assumption, reversing the direction commonly seen in scholarly research, where the creative process(es) traditionally support technological research, rather than the reverse. This technologically-supported choreography is possible through the incorporation of technological manipulation —namely, a computer's ability to shuffle frames of a video.

Pereira et. al. recently quantified (what was once "not previously imaginable") an animal's intentions, behavior, and motive as it navigates an environment [4]. Although this paper may appear disconnected from my original inquiry, it still supports and investigates how animals move and how other animals interpret that movement. These animals have total autonomy over their movement; humans have total autonomy; computers do not have autonomy. While a computer is typically controlled by its autonomous operator, this research seeks to reverse these roles, asking the computer to "autonomate" its operator. Pereira's research of cognitive behavior in animals will reveal similarities and/or differences between the "cognitive behavior" of computers and the cognitive behavior of animals [4].

The two fields, computer science and dance, struggle to find bidirectional implications and similarities. However, works by Angela Sigley Grossman [5] and Wayne McGregor[6] are directly challenging the unprecedented workings of *Artificial Intelligence* (AI) and *Machine Learning* (ML) in the context for choreography. Grossman's 2024 piece *Render* is "an exploration of the intersection of generative artificial intelligence and dance-making" [5].

Wayne McGregor's *Living Archive: An AI Performance Experiment* uses a "revolutionaly artificially intelligent choreographic tool" to push the limits of choreography questioning "Who has to make choreography?" [6]. An important limitation of McGregor's work is his affirmation that "there is always a human in the loop, because there isn't an algorithm that can judge the quality of the choreography" [6]. Both of these projects use AI and ML to support the development of their choreography, but stop short of allowing computational systems to wholly define or produce the piece.

This project seeks to echo those limitations under a different lens: permitting machines to direct the *sequence* of choreography, though not the movement. While McGregor's comments and insistence on a human-in-the-loop facilitator do affirm the current absence of a "choreography-quality" algorithm, they also suggest that such an algorithm does not—or perhaps cannot—exist [6]. Algorithms are not limited to computers: *humans all have individual algorithms* —strategies for analysis, synthesis, and judgment. Using humans to unknowingly quantify the quality of a computer's choreographic choices will produce a close replication of the non-existent algorithm McGregor describes. Although these two examples showcase the incorporation of computer science in movement arts research, their shared methodology and vision reflect the lack of diverse and critical inquiry in this field; this study plans to broaden this field.

Finally, computer science is notoriously algorithmic and rarely intersects with creativity. Maria Knobelsdorf and Ralf Romeike investigated *Creativity as a pathway to computer science* to "explore characteristics of creativity and the question whether creativity forms a possible pathway [in] Computer Science [7]. The two authors concluded that "astonishingly, creativity is rarely reflected in CS education research" and that "a bigger emphasis on creativity in CS classes is needed in order not to bore and [lose] more creative students" [7]. This project directly responds to that gap. By introducing dance—a fundamentally creative and expressive discipline—into an algorithmic and computational process, I attempt to frame computer science not as a rigid structure, but as a collaborator in creative production. This project serves as a case study for creativity as a medium and message in computational work.

3 Methodology, Delimitations, and Limitations

3.1 Methodology

This project involved multidisciplinary tools spanning dance development, software engineering, video editing, musical accompaniment, and qualitative data analysis.

3.1.1 Dance Development

The original choreography was developed through an iterative and encapsulating process, supported by impulsive tonal adjustments and reasonable movement transitions. To begin, I engaged in a reflective and meditative practice without technological distractions other than Keith Jarrett's *Köln Concert* [8]. Stress mystified me, namely "*how humans stress[ed]*" and "*where stress stems from.*" A machine's inability to *stress* stems under a presumption of all-knowing, or conversely its inability to experience crises. A machine's *naïveté* and *certitude* guided the rest of my movement, iteratively planning movement on a white board (**Figure 1**). I memorized the generated movement and performed it in front of a camera *eight* times: once from each cardinal angle, with two takes per angle. I memorized and followed the same recording procedure for the **CRC**.

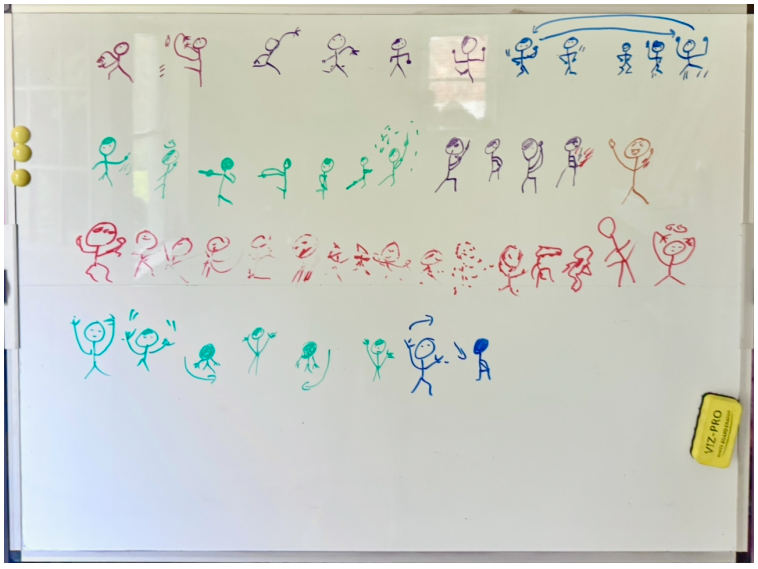

Figure 1: Initial movement ideation drawn on a whiteboard during reflective choreography planning.

3.1.2 Software Engineering

The original choreography—after completion—was manipulated by computer software to shuffle and reorganize the frames into a newly developed choreography. The CRC sequence was generated using a custom Bash script with FFmpeg.[1] Although many methods for shuffling were employed, the algorithm used extracted **every frame** in the video, chose two random frames as starting points, collected n sequential frames for both starting points, and swapped these two frame collections m times. N and m were chosen varyingly; ultimately I used the values *10 frames* swapped *20 times*. The program generated more than 100 results. One video was selected as the target CRC through a combination of aesthetic coherence and physical feasibility, as its randomized sequence presented a compelling yet performable challenge.

Figure 2: A frame shot of the same movement at different timestamps. The movement was moved due to computational shuffling.

3.1.3 Video Editing

The original choreography and the CRC were shot for film. Eight performances from four cardinal angles were shot in front of an iPhone 15 Pro Max on a Hohem *Gimbal Stabilizer*. Using Apple's *Final Cut Pro*, I edited the eight performances—two from each angle—into a cohesive video. This process allowed the movement to be fully translated into film for a complete visual understanding.

[1] https://github.com/gavincaul/CRC-Code

3.1.4 Musical Accompaniment

The original choreography and CRC were assigned original and improvised piano accompaniment. Using Apple's *Logic Pro X*, I repeatedly watched both videos and improvised a minor piano piece in response to the movement. Although all of the music was performed through a MIDI transcriber on my Yamaha *Digital Piano P-125*, audio effects (such as reverb) and minor MIDI note edits were used to touch up the final musical product.

3.1.5 Qualitative Data Analysis

Within the pilot study, the participants watched the original choreography and CRC and responded to questions about both videos. The questions were the following:

Q1. What did you see? What stood out? Are there details you remember most?

Q2. Movement has a way of shaping stories, messages, and/or emotions.
Did you experience specific ideas, thoughts, and/or feelings watching this piece?

Q3. Did you perceive any **coherence** in the movement? If so, how would you describe it?

Q4. What would **you** change about the piece as a whole?

Q5. Would you consider the movement you saw to be a dance *piece*?

Answers were taken into account individually with respect to each video. The best descriptive elements were extracted from each answer and were used for comparative analysis.

3.2 Delimitations

There are a handful of delimitations in this project. Firstly, only two videos (despite the possibility to create hundreds) were finalized; the rest of the videos were not taken into consideration or used in any other part of this study. Moreover the musical accompaniment must mostly be improvisational and assigned after choreography development as to avoid any directional or musical bias upon the movement. Although the movement is not officially bound to a genre or style, modern and contemporary best categorize the chosen movement. Other avenues and styles will not be explored. Moreover, frame extraction is not the only method to shuffle videos, but no other method will used. There are no limits to the number of participants in the study.

3.3 Limitations

This study is subject to many limitations. Due to the results being highly dependent on the data, insufficient, irrelevant, or incoherent responses may mislead or distort the results. Moreover, the study may not yield enough participants to produce an accurate, directional result. Results may suffer from less participants than desired, or a lack of diverse participants. Additionally, some responses may be subject to bias, such as participants answering carelessly, misunderstanding questions, or responding in a way they believe benefits them personally rather than reflecting their true opinions. This response bias may distort the data and reduce the reliability of the study's conclusions. The program takes a long time to shuffle videos, which prevents newer, more abstract and larger videos from being included in the final cut. Also, the time allocated for choreography may not be enough to create a fleshed out and meaningful piece—however, the needed amount of time is unknown. The same time limitation applies to the musical accompaniment. The time constraints, coupled with *physical illness* during the dance process, impacted my ability to execute movements effectively and may have hindered the overall quality of the performance. Finally, participants expressed a tendency to *compare* the two videos, despite the intention for participants to interpret each video individually. This comparison likely led to skewed results.

4 Findings

Over the course of five days, the study received **10** participants. Of the 10 participants,

- **6** participated in dance previously; **4** did not.
- All participants were between the ages *18-24*.
- All participants have a *high school education* or higher.
- **6** participants *correctly guessed* the original video; **4** did not.

Participants were asked to respond to survey questions following each video. The following comments highlight each video. Full responses are available in the appendix and can be accessed via the linked spreadsheet.

The following comments were left on the *original video*.

- "[...] most of the moves matched each other and looked somewhat similar."
- "Dance felt anguished and sad —maybe the dancer feels trapped?"
- "[Felt like] I was rooting for a hero in a movie."
- "Mechanical chaos."
- "Expression of emotion that seemed worrisome."
- "Repetition helped paint a certain type of story."
- "Started off more contemporary and then felt more abstract."

The following comments were left on the *CRC*.

- "Each type of movement—whether reaching and elongated, quick and short, turning, pointing, repetitive—felt like they were functioning as one part of a bigger story."
- "deliberate movement to song motifs and emotional decisions"
- "Idea of 'catch and release.'"
- "And it felt like the whole dance was one man's journey."
- "Piece felt ambiguous but also more hopeful."
- "Movements blended together well, and there were different uses of dance technique that added depth to each movement."
- "More expressive and sharp."
- "[the specific ideas, thoughts, and/or feelings were] harder to describe."

Recurring themes from both dancers and non-dancers alike appear in the responses above. The original choreography was often described with words like "anguished," "trapped," and "mechanical chaos," with several participants noting a strong emotional tone and narrative suggestions. Multiple viewers referenced repetition and emotional expression, and one participant described the experience as "rooting for a hero in a movie."

The CRC elicited comments that emphasized structure, technique, and thematic cohesion. Viewers described it as "more expressive and sharp," with movements that "blended together well" and "felt [these movements] were functioning as one part of a bigger story."

Several participants noted a sense of emotional ambiguity, with one calling it "ambiguous but also more hopeful," and another highlighting the "urge to dance but also [with] resistance."

These responses reflect different viewer perceptions between the two versions in terms of clarity, emotional tone, and movement quality.

Participants were asked to provide which elements they focus on while watching a dance performance. Of the categories provided—Music and rhythm, Movement precision, Emotion and expression, Visual composition (lighting, editing, framing), Story or narrative—**60%** of participants selected *Music and rhythm*; **70%** selected Emotion and expression; all other results were selected by less than **30%** of participants. There was no correlation between selected elements and dance experience.

5 Discussion

5.1 Interpretation of Results

I conducted a study in which **10** participants watched the original choreography and the CRC (order determined randomly via coin flip; participants unaware of the order) and answered survey questions. The questions mainly targeted the movement's coherence, expression, and details. Following the viewing of both videos, participants were asked to identify the *original video*. **Key Findings:**

- **60% or participants** successfully identified the original video.
- Among participants with **dance experience** (n = 6), only **50%** correctly identified the original video.
- Among those **without dance experience** (n = 4), **75%** correctly identified the original.

These results suggest that experience with dance may be correlated with a decreased ability to distinguish between the original video and the CRC. Those with significant dance experience likely have been exposed to more contemporary or abstract pieces. This exposure

encourages broad-minded perception standards for dance. This openness may reduce their sensitivity to the structured qualities that differentiate an original from a procedurally generated piece. In contrast, those without dance training might find the CRC's lack of intuitive coherence more conspicuous, thus making the original choreography easier to recognize. Although deceptively masking an original video over a CRC could (and seemingly would) fail, it is not without reason to use computer manipulation to enhance the dance experience.

The human condition lives eternally throughout each life, yet describing it takes significant creative effort, especially when trying to reach larger groups of humans. Traditionally lacking creative and critical thinking capabilities, a computer's attempt to craft a thorough and coherent choreography could likely wash away the emotional communication of a dance piece. Descriptions and interpretations of the CRC beg to differ. For the original video, many participants described the piece full of "anguish," "sadness," "struggle," and other intense emotional qualities. In the CRC, participants described the piece in *more* emotional depth than the original. Many participants described the movement and emotional communication as *deliberate*, expressive, ambiguous, and rational. The depth of emotional reciprocation insists that the CRC directly contradicts the assumption of computational unimaginative procedures; an assumption of over *50* years[3]. The answer to this contradiction is unclear. However, as humans normally crave order—as randomness leads to confusing and patternless results—randomized choreography can create a confusing and *more interpretive* piece. Randomized choreography can push boundaries and limitations humans frequently (perhaps unknowingly) disregard. Randomized choreography disrupts comfort and order. However, participants were able to qualify the randomness into repeated descriptive qualifiers such as "sharp" and "expressive." Rather than detracting from artistic value, computational randomness may reveal unexpected emotional resonances, challenging traditional assumptions about the role of authorship, structure, and intention in dance. These findings invite further exploration into the complex interplay between randomness, perception, and meaning in choreographic expression.

5.2 Implications for Computational Creativity

In his satirical essay, Daniel E. Koshland presents a malfunctioning computer that defies its programming by sending absurdly inflated subscription bills, prompting reflections on value, logic, and machine autonomy [3]. Humorous in tone, the narrative raises provocative implications about the nature of computational creativity. This defiance would normally be

dismissed as a bug, an err in the computer's logic system, though the computer's actions were not a malfunction—the computer *reinterpreted* the subscription value, which suggests the computer assigned symbolic value, a behavior reserved for conscious creative agents. Koshland closes his article with a question answered by leading artificial intelligence (AI) researchers, when asked whether if "creativity [is a] quality that we seek in computers," the response was a blunt "no" [3]. This dated, fifty-year old response from the pioneers of AI set a standard to disregard creative agency in computers. Koshland hopes the "rebellious computer spends its weekend working on problems of arms control, famine, and the environment," problems human intelligence has yet to solve[3].

The notion of insubordinate computer(s) parallels findings from the current choreographic study, where randomly shuffled sequences (CRC) provoke human interpretation and consideration, namely from a tool with a "heart of steel." Koshland and the AI developers he probed ultimately decided against celebrating a creative computer, noting that practically machines must be reliable, not creative or insubordinate [3]. In the broader context of machine learning, generative art, and choreographic intent, this study contributes to ongoing debates about authorship, agency, and creativity. Machine-generated works, even when built from *stochastic* or pattern-based processes, can evoke emotional and aesthetic reactions that rival or exceed those of human-originated content. This human and machine creativity blurs the boundaries of intention and creative agency in machines and their users. Regardless of the source, all art, human or machine-generated, is still judged through human-interpretive lenses. The reception from the CRC underscores that conscious artistic intent does not necessarily derive from *intent*, but rather the **perception of intent** and **meaning**—especially in intentional scrutiny of abstract pieces.

Thus, the expressive impact of the CRC—and the absurdist act of the rebellious computer—both highlight a growing reality: machines, deliberately or accidentally, produce outputs that engage us as if they were art. This complicates our understanding of creativity as a purely human domain. Ethics aside, machine-generated creativity can make way for new aesthetic experiences—ones that humans might not conceive or replicate on their own. Koshland's computer was dismissed, as creative machines often are, because it defied the expectation that machines must remain reliable and predictable. But must all machines be confined to that box? This study challenges that notion—it says no.

This dynamic mirrors research by Pereira et al., who quantified animal behavior and inferred intention through movement alone[4]. In that study, motion served as a readable expression of inner motive—even without verbal communication or higher-order reasoning.

Similarly, in the CRC, audiences assigned emotional and expressive qualities to sequences generated without conscious intent. If movement alone can imply motive in animals, then perhaps the same holds true for machines. This raises a deeper question: if we can interpret intention in animals based on observable behavior, can we extend a similar interpretive framework to computers, whose "behaviors"—like choreography—are constructed but perceptually autonomous?

5.3 Reflections on the Interdisciplinary Process

This project emerged from my desire to intersect my programming abilities with my creative identity as a dancer. Driven by curiosity and experimentation and the unpredictability of randomness, I sought to bend the tradition of precision and finality that define programming tasks. There did not exist a "perfect" CRC; an answer did not exist. That unpredictability, foreign to a computer's usual functionality, made the creative process incredibly compelling.

The code served as a collaborator in this process. Not a choreographer or teacher, the computer gave me material to respond to. The programming and creative intersection offered a chance to give the computer *a voice*: I had the privilege to speak on behalf of a voiceless entity. The computer's words, however, posed a challenge that I needed to interpret. The computer asked me to sift through its output and *bring it to life*.

As a dancer, I frequently lean on improvisation and intuition. I typically build movement from exploring transitions—finding how point A becomes point B. With the CRC, those points were already determined. I was not generating new content, I was interpreting randomized content and trying to find a coherent pathway through it. It required a different kind of creative effort.

Performing the CRC felt fundamentally different than the original choreography. Aside from the limitation of physical illness, I struggled to embody the computer's movement and intent. I struggled to emotionally invest myself in the generated movement—the arrangement originally from my body now felt foreign, doubled down on my intention to treat the movement as a blank slate: I had no intention to infuse emotional intent from the original into the CRC. Regardless, the CRC surprised me with exciting, interesting patterns and expressive moments that I would not have come up with. This unanticipated movement reframed dynamic and emotional arcs that brought a sense of cohesion to the movement. This effect is backed by the reception of the CRC, where multiple participants aligned the

CRC with depth and an aesthetic unseen in the original.

Through this process, I was reminded that dance is not meaningful purely from intention but also from its' reception. Even in randomized sequences, audiences find meaning. This reframes choreography to an open-ended, interpretive act. Choreography is frequently treated as a means to an end: a polished performance. But computational randomness creates new movement strategies and allows a machine to disrupt the repeated artistic intent of choreographic production. Art deviates the norm, and in this project, the machine—typically aligned with logic, repetition, and predictability—revealed its potential to deviate from itself. Through randomness, it disrupted the very structure it was built to uphold. Paradoxically, it disrupted its own logic. In that rupture, something strangely human emerged.

6 Conclusion

6.1 Summary of Key Findings

In this study, two videos—an original choreography and a computationally randomized choreography with musical accompaniment—were presented to 10 participants in a pilot study to explore the perception and interpretation of computational randomness in choreography. Participants with dance experience seemingly struggled to differentiate the original video from the CRC, suggesting that familiarity with dance may not aid in distinguishing human intention from algorithmic assembly. More importantly, both videos elicited insightful and emotionally resonant interpretations. Notably, computational shuffling did not prevent meaning, but rather produced arguably deeper and more nuanced interpretations in comparison to the original. Furthermore, this study allowed creative intersection with logistical computing to create a nuanced artistic vision otherwise unreachable by my boundaries.

6.2 Limitations Revisited

In light of the results, time, illness, and interpretive biases may have skewed the production and results of this research. A common critique of the CRC was the lack of expressive movement. Coupled with limited time, physical illness prevented me from producing extensive work, which could have led to a misinterpretation of the artistic goals of the computerized choreography. However, as concluded before, intention does not fully dictate the meaning

of a dance piece, rather the reception and perception overtly provides meaning. However, any change to movement (such as weak movement) will alter the perception, and possibly skew reception. This is not lost on me, though I am not upset with the results. Although the number of diverse participants was a worry for this project, ultimately the quality of responses eased that concern, garnering thoughtful, insightful, and deep responses. Furthermore, coupled with an unknown target participation number, I am no longer concerned about the participant demographics. However, participants, despite instructions, often compared the two videos rather than evaluating each individually, which may have influenced their responses. While this reflects a natural human tendency toward comparative analysis, it nonetheless introduces a bias into the study design. Despite these limitations, I am not dissatisfied with the results. If anything, these imperfections emphasize a core theme of this project: that meaning in dance is co-constructed by both the performer and the viewer.

6.3 Broader Implications

As we exit the age of information and dive into an age of intelligence, AI and all of its use cases are still unknown. Though AI and art is a sensitive subject—namely for the erasure of artistic talent, intention, and meaning—this project uses computational programming as a means to an ends; a tool for a richer quality of work. Although this project does not answer the ethical line of using computational abilities to create and/or enhance art, it could serve a framework for computational involvement in choreographic processes and procedures.

6.4 Future Work

This project has many capabilities for expansion and development. Firstly, a larger and more diverse participant pool can yield new unseen receptions to either video. These new results will give more insight on the perception and reception of computational randomness. Secondly, this study can benefit from different programmable parameters, such as a higher rate of frame swapping, larger sections of frame swaps, and even multiple runs of the program onto the same input video. The limitations of computational randomness and choreographic nonsense is unknown; how far does computational randomness bring choreography? Finally, a larger production standard for the videos, and multiple longer videos can produce different, possibly more accurate results. For now, there are no plans to develop this study in the future.

6.5 Final Thought

Driven by curiosity, interpretation, and a desire to represent the human condition, this study explored an often overlooked counterpart to creativity: the *machine condition*. Machines, typically regarded as methodical and consistent, are rarely granted creative agency or interpretive potential. They are treated as voiceless vessels—tools that carry out human will. While a machine's capacity for genuine expression remains uncertain and perhaps unresolvable, this study offered a platform for *machinal* expression. Here, the machine was not just a tool, but a participant in a creative process. It generated movement that, though devoid of a living experience, invited human interpretation and emotional resonance. In doing so, the machine did not replicate the human condition—it expanded it.

A machine may not feel, but it can provoke. It may not interpret, but it can suggest. The choreography it produced—born from randomness and repetition—challenged assumptions about authorship and intent. It proved that creative meaning can emerge not only from intention, but from structure, perception, and surprise. Machines will never live the human condition. But through imaginative use, they can reshape how we understand it. As creators, it is not just our prerogative, but our creative obligation to let them speak.

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Appendix

A. Survey Questions

Demographic Information

- **Name:** _____
- **Email:** _____
- **Age:**
  - Under 18
  - 18 - 24
  - 25 - 34
  - 35 - 50
  - 50 - 65
  - Over 65
- **Gender Identity:**
  - Male
  - Female
  - Non-binary / Non-conforming
  - Transgender
  - Prefer not to respond
  - Other: _____
- **Educational Background:**
  - No schooling completed
  - Nursery school to 8th grade
  - Some high school, no diploma
  - High school graduate (or equivalent, e.g. GED)
  - Some college credit, no degree
  - Trade/technical/vocational training

  - Associate degree
  - Bachelor's degree
  - Master's degree
  - Professional degree
  - Doctorate degree

- **Field of Study or Professional Background: _____**

Dance Experience

- **Do you have background in dance, choreography, or movement arts?**
  - Yes
  - No
- **If yes, please describe: _____**

- **When watching a dance performance, which elements do you focus on? (Please choose no more than 2)**
  - Music and rhythm
  - Movement precision
  - Emotion and expression
  - Visual composition (lighting, editing, framing)
  - Story or narrative
  - Other: _____

- **Do you have experience with any of the following? (Check all that apply)**
  - Watching professional dance
  - Creating choreography
  - Performing dance
  - Studying dance theory or history
  - None of the above

B. Video(s) Survey Questions

Participants answered the following five questions after each video:

Q1. What did you see? What stood out? Are there details you remember most?

Q2. Movement has a way of shaping stories, messages, and/or emotions.
Did you experience specific ideas, thoughts, and/or feelings watching this piece?

Q3. Did you perceive any **coherence** in the movement? If so, how would you describe it?

Q4. What would **you** change about the piece as a whole?

Q5. Would you consider the movement you saw to be a dance *piece*?

C. Participant Video Survey Responses

This section contains anonymized answers from participants to each of the five survey questions. Responses are organized by video and can be accessed via the following spreadsheet:

Participant Survey Responses Spreadsheet

C. Bash and FFmpeg Script Excerpt

```
#!/bin/bash
...
echo "Extracting all frames..."
ffmpeg -i "$input" -qscale:v 2 "$work_dir/frames/frame_%05d.jpg" -loglevel error
...
for ((j=0; j<group_size; j++)); do
    idxA=$((startA + j))
    idxB=$((startB + j))

    tmp="${frame_files[$idxA]}"
    frame_files[$idxA]="${frame_files[$idxB]}"
    frame_files[$idxB]="$tmp"
done
```

The complete code can be accessed on GitHub Repository.

D. Tools and Software Used

- **Final Cut Pro (FCP)**: Used for video editing and performance filming.
- **Logic Pro X**: Used for composing the soundtrack.
- **Bash**: Used for scripting choreography manipulation.
- **FFmpeg**: Used for processing video frames.
- **Yamaha Digital Piano P-125**: Used to produce musical accompaniment.
- **iPhone / Gimbal**: Used for filming and stabilizing shots.