36 Walk: a case study of reciprocity in movement and computation

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ABSTRACT
In the context of a choreographed media arts performance, we consider the relationship between movement and computation. We describe the case study of one sequence of this performance, 36 Walk, a composition that is built on algorithmic precepts. Drawing on observed experience from a series of movement and design residencies, we outline potentials for new relationships between movement and computation found within this project. We describe the need for new reciprocal relationships between computer and performer and highlight an opportunity space for movement and computation.

Categories and Subject Descriptors
H.1.2 [**Information Systems**]: Models and Principles – *User/Machine Systems;* H.5.2 [**Information interfaces and presention**]: Multimedia Information Systems – *User Interfaces;*

General Terms
Algorithms, Documentation, Design, Human Factors

Keywords
Computation, movement, media arts, dance, performance, installation, exhibition, case study, user interaction.

1. INTRODUCTION
All human movement can be understood as expressive; from the pedestrian and quotidian to the highly codified, stylized and constructed movement of choreographed dance art. In the west a sweep of post-modern dance forms, from the 1960's to the present, shifted approaches and perspectives in how dance artists worked with movement. Critical of both the form and content of 'classical' forms (e.g. ballet, modern) dance artists ask; 'what is dance and what could it look like? Is how it feels important? What other conceptual spaces might it [the world of dance making] inhabit?' These and similar questions opened the field on many aesthetic and societal levels.

Our work explores these questions through the intimate joining of two systems: first, the *kinesthetic and choreographic* system that makes up the foundational and functional aspects of a dance event; and the *procedural, algorithmic* systems that composes the 'bones' of the computational tools.

Drawing on the term 'functional integration' from the Feldenkrias method [2], we ask how these systems might be brought in closer alignment with one another? Referring to greater integration of one's self through awareness of and attention to physical movement, this concept is helpful in considering new forms of media arts for dance, which is not based on the computer as representational control and display system, but on the *hybrid interactions of tactical bodies.*

We do this by leveraging that which is 'natural' or 'fundamental' to each system in the ways it makes meaning. 'Computation' for dancers, is internalized. In designing a computational system to play in, we move away from showing figurative translations, representation of movement on screen, to explore how media works not as a backdrop or décor, but as an actor or agent in the dance. Choreographed movement for live performances is often complex, unbounded, rhythmic, and spatialized. When other media (sound, lighting, image) are introduced, it is often in service of the movement: to follow, respond, to enhance, to direct. The relationship between the media and the movement is often joined to punctuate or extend the movements' meaning, and effect how the choreographed movement is 'read'. When aspects of the choreography are spontaneously chosen (i.e. improvised), the relationship of movement to media shifts. This raises consideration for the use and benefit of pairing computation with performance. On the one hand, it helps to craft a more meaningful, more vivid performance experience, for both audience and performer. This requires the realization of a computational model that mirrors, follows, leads and responds to the complex movement and *choices* of the performers. Achieving this effectively means mediating many multifaceted issues. For example, does the computation, or its products, need to be legible within the space, to the performers and/or to the audience? If the computation controls media, does the model then, function as a complex series of triggers, in relation to movements of the performer and if so what are other strategies for a computational model to behave in relation to a performer/s? Finally, how much does this 'behavior' effect the decisions of the performer, and how explicit does this relationship have to be in order for it to be meaningful to the viewer?

Choreographed movement is a whole and complete signifying realm, so the question of movement in communication with a computational system as two, co-existing entities that, by product of happening in simultaneous place and time, draw meaning from each other (e.g. Cage/Cunningham). In this case, the computation then models not the performers, but the space and the environment. In direct response to this, the intention behind our work is to create, develop, and produce strategies for greater cohesion and communication between computational systems in media arts, and the methodological systems of choreography with composed and improvised movement. We approach this research by leveraging their mutual synergies through practice-

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based research into choreographic processes and computational procedures. We ask:

How is choreography like computation? What is expressive movement? How might we develops more intricate, interdependent relationships between the functional building blocks of dance movement and choreographic structure [rhythmic, spatial, physical, etc.] with the designing of computing models to act; not as decor, gesture tracking, or cueing system, but as another 'character' or agent in the unfolding of the performance event?

These questions are explored in this paper as follows. First, we outline our perspective on movement and embodiment, leading to a few of media arts approaches to integrating movement and computation. Next, we describe the project and a case study of algorithmically generated improvised dance. Following which, we discuss the relationship between this piece and computation and describe a new opportunity space for integrated and reciprocal computer/performer relationships which we have identified.

2. BACKGROUND

2.1 Movement and Embodied Action

"Physically, our experiences cannot be separated from the reality of our bodily presence in the world; and socially, too, the same relationship holds because our nature as social beings is based on the ways in which we act and interact, in real time, all the time."

In envisioning the next generation of HCI, Dourish explored notions of *embodied interaction* to guide and expand the domain of human-centered design [1]. Yet these interactions are most often described between 'user' and 'system'. Our research emphasizes the affordances of human movement through a more explicitly kinesthetic engagement, which acknowledges and leverages interactions between *system* (computational) and *system* (physiological.) Somatic concerns of orientation, gravitation, timing, and the complex coordination of these elements in navigating our environment, impact our perceptual experience, and therefore the way we make meaning.

If phenomenology is a conceptual investigation of these perceptual experiences of everyday life, the domain of Somatics is a practice-based investigation. It seeks to expand awareness of the ways we exist in the world through reflection on one's own movement. In his 1964 article "Mind and Body," Moshe Feldenkrais discusses the concept of "functional correspondences" by explaining his framework for describing a human being in [its] "entirety […] the nervous system, which is the core; the body – skeleton, viscera and muscles – which is the envelop of the core; and the environment, which is space, gravitation and society." [2]

Acknowledging that all human experience is 'embodied' to one degree or another, Feldenkrais (among other pioneers of somatic research) posits that even the notion of abstract mental reasoning has its muscular component: "at least, the continuity of mental functions is assured by corresponding motor functions […] It takes us longer to think the numbers from twenty to thirty than from one to ten, although the numerical intervals are the same between 1 and 10 and 20-30. The difference is that the amount of time needed for thinking the numbers is proportional to the time needed to utter them aloud. So one of the "purest" abstractions – counting – is inextricably linked with the muscular activity through its nervous organization." [2]

2.2 Movement, Response and Interaction

The availability of low cost sensing real-time platforms (e.g. Kinect), and new creative platforms for expressive representation (e.g. Processing, Max/MSP) has empowered many recent explorations into computation and movement. These representations are still broadly arranged into just two major categories: 'computational décor' and 'gestural expression'. While explorations into both have extended and advanced computational models for movement, they serve different intents and audiences. Merce Cunningham's 'Biped' [3] offers the canonical example of 'visual décor' derived from computational understanding of movement. Here audio-visual environments are created to couple with and cue kinesthetic movement. Shelly Eskar, Paul Kaiser and Marc Downie's work highlights how technology-performer relations in this context are often mediated not by dynamic coupling but instead by close coordination through choreography and rehearsal. While Downie's work in this regard is based on computational emergence, in-situ and as 'visual décor' such approaches do not extend well into less coordinated and more improvised scenarios. The work of Sha [4] provides an excellent exemplar of gestural environments where movement is sensed and mapped to the audio/visual responses. This approach is as Corness and Shipport [5] note (via Rowe [6]) a "*traditional model for interaction between performers and computer systems*" focused on *"the system's ability to sense gestures and generate a response*." Gestural expression creates a stronger, more dynamic, connection between technology and performer, however it offers a model where the algorithm serves as an instrument to be manipulated by a performer [15]. Typically, repeatability is emphasized such that similar kinematic motion will results in predicable outcomes. This affords performers opportunities to explore and choreograph the tool, but places computation in service of motion. Birringer discusses this 'contradiction' in real time dance - and that, as a 'anticipatory, virtual practice of calculation' it does not need to be reconstructible and suggests a need to find new couplings, aesthetics and mathematics for the creation of interactive dance [15]. In light of this, and as Rowe suggests [16] (albeit in the context of improvised music) we are interested in circumstances where we can foster a true[er] collaboration between humans and computers in improvised performance.

Others have similarly explored this space. Shipport provides an alternative strategy to 'traditional' gestural expression in 'Between Bodies' [7] where rather than situating computation in an expansive or expressive media rich environment. Favoring a more intimate approach, Physiological measures from performers are used to generate movement vocabularies through introspective response to sensed information. Unlike the responsive environments of Sha [4] where movement drives computation, here computation drives movement. Suna no Onna, described by Birringer [15] leverages wearable technology to mix autonomous behaviors in the digital environment with kinematic, sculptural and cinematic forms where no consistent repetition is possible. Shamma et al explore similar concepts but at a much larger scale. In their work, a dynamic system that creates media representations from syndicated, social and online sources in turn, drives performer action by "*drawing on the lineage of 'if/then' methodology introduced by choreographer Richard Siegal in 2004.* [8]" Finally, inverting traditional approaches to movement and computation, Sheppart and Nahrstedt [9] explore mediating performance through virtual spaces. They shift performance from real spaces to shared virtual environments allowing dancers to participate in constructing performance without the need to be

collocated. This work in particular emphasizes the new and unexpected values which can be found in computational approaches, illustrating the 'glitch' or 'crash' not as a bug to be fixed but as "*an exciting opportunity for the dancer.*" The reciprocal relationships that can emerge between performer, choreographer and system is also evidenced with new frames of authoring, noting that TED (tele-immersive dance) "*was like working with another partner, like it had a life of its own*." This aligns with our view that there could be a closer coordinating relationship between performer and system.

However, few systems have fully closed the loop between sensing-and-feedback to facilitate the development of such rich relationships in real-time and in improvised settings. Corness and Shipport again comment that "*while a performance, even when non-verbal, may be seen as a form of discourse or conversation, current systems continue to focus on becoming more responsive rather than interactive*." However, few systems have fully closed the loop between sensing-and-feedback to facilitate the development of such rich relationships in real-time and in improvised settings. Corness and Shipport again comment that "*while a performance, even when non-verbal, may be seen as a form of discourse or conversation, current systems continue to focus on becoming more responsive rather than interactive*." Part of this lies in the challenge of developing such interactivity. This is not limited to the technical overheads and complexities of developing real-time, dynamic performance environments but also in how they can be integrated into their intended contexts. Downie notes this particular difficulty - the ability to sufficiently rehearse computational models with performers. He solves this through a new tool for performance, *Field*, and by choreographing both computational and human agents through progressive iteration and rehearsal [17]. While *Field* solves one challenge it does not offer responsive, interactive models to facilitate improvised, dynamic interplays. Such inquiry is most closely aligned with 'Post Choreography' thinking [15] where '*both performer and system respond to the other's enaction by undergoing self-permutations on the basis of distinct operational rules.*'

This process of developing the computational rules is typically, however, highly reductive, relying on abstraction of movement to move into the digital. Modeling often removes or ignores the more nuanced, unique facets of live performance and performative interactions (cueing, non-verbal communication, intuition, etc.). Although the 'motion' and behavior of software agents and human performers are different and carefully distinguished [15,16,17], there are still many open questions about the role of the system and the nature of performer-technology relations that can be expressed within computational models for movement. Corness and Shipport [5] discuss these questions in detail [5] and additionally explore embodied agents as mechanisms to be used to enhance coordination by incorporating social cues (in this case, intuition) in computationally modeled interactions. This example of bridging embodied knowledge between the digital and physical is particularly potent, however as yet there have only been a limited number of explorations into this space. As Shipport, Sheppard, Loke and Lin summarize: "*there is a gap in interdisciplinary research that explores the intersection between two distinct epistemologies of practice: the embodied cognition of the moving body, and the computational modeling of complex intelligent behavior and action* [10]." Building on the work of Rowe [16], Birringer [15], Shipport [5], Sha [4] and Downey [17], we seek to address this by taking an algorithmic approach to a score for choreography in order to learn to better approach computational modeling for interactive performance.

Figure 1: 36 Walk [courtesy of artist]

Figure 2: Treadmill Walk [courtesy of artist]

3. echo::system

echo::system is a fusion of participatory art installation, choreographed multi-media performance, and public engagement that looks to mediate connections in art and science that promote reflection upon our impact on the natural world [14]. The project is conceived as a series of five, large-scale, multi-media environments constructed for both live performance and participatory installation. Each environment corresponds to a natural habitat: #1Abyss, #2Desert, #3Forest, #4Prairie and #5Volcano. Collectively, these works are called 'actionstations', each based on a natural habitat, yet developed as a hybrid of real and imagined data using myth, timescale, and ecological information to inform the creation of the work in a tradition of speculative fiction. echo::system looks to understand how live. It does this by drawing on the lineage of performance art and in particular time-based art which can play a critical role in the integration of abstract information and complex current events with our everyday, lived experiences through tangible, aesthetic, real-time experiences. The performance puts the highly visceral terminology of contemporary dance in a media rich space, envisioning a meta-environment. Live performance, and particularly dance, emphasizes knowledge based in the present physical moment, and expressing these moments in time is one of the strongest aspects of this form. Through this sequence of events that goes from participatory installation to observed performance, this project looks to leverage the power of both kinesthetic experiences to dynamically communicate and connect sensory experience to information space, real and imagined.

In creating movement for this work, themes and images relating to the relationship between the 'desert' and 'urban' informed movement construction and studio exploration. These include the city in the desert, the parking lot, the grid, the ambulatory, quicksand, locomotion through concrete vs. sand, verticality of

the urban landscape vs. the horizontal vistas of the desert, thirst, mirage, oasis, etc. However, the structural underpinnings of the section '36 Walk' is based on a set of rules and numbers that the dancers memorize and then use as probabilistic score for highly composed opportunities for improvisational movement in rehearsal and performance. (see Fig 3.) Over a four-week movement and design residency, the collaborative team of dancers, architect, computer scientist, video and sound designers observed the evolution of the choreography for '36 Walk'.

4. CASE STUDY: 36 WALK

Algorithms are central to designing and conceptualizing computational systems. 'Expressive' movement, in the form of choreographed dance is not often imagined as being 'driven' by algorithmic procedures, although there are many examples of post-modern choreographers (e.g. M. Cunningham, T. Brown) using procedural methods to create what we will call 'composition scores' or scores for improvisation in order to generate patterns that neither individual performer nor directing choreographer can predict. Music composers and the particular legacy of electronic music have leveraged these generative/emergent algorithms as creative and compositional strategies. When the medium of expression is the body moving in space and time, the potential relationship between mover and computational system shifts and expands.

'36 Walk' is an example of such investigation. A section from the larger performance work described above, it is based on a compositional score for live voices, which is translated into a score for movement. The section also directly addresses and incorporates the broader themes of the work; an ambulatory narrative which explores the transitional space between urban and 'country' environments. The movement design is inspired by ironies embedded in mechanically assisted modern walking machines (i.e. treadmills, modern gym, et al). Embedded in the score is a series of 'rules' defining movement characteristics and performer interactions. The dance is spatially arranged on and off 'the grid', metaphorically playing on traditional perspectives of space, and the differences between the computational/technologic space and human beings experience of moving through space. The performers movement is defined as a series of spatial strategies, including concepts of 'snap to grid', 'ambulatory' and 'wandering'.

Performers' movements are guided by a heuristic mechanism as illustrated in Fig 3. Typically performed with six dancers, they begin stationary and positioned randomly on an imagined grid. They follow a rhythmic score, played aloud or through in-ear devices.. Each dancer is asked to hold a 'count' in their head, which determines the points at which they can choose the next movement. At each count, the dancer may choose to continue in their current direction, choose a new path, or pause. They may also choose to exit the stage, but may only re-enter at the '1' count.

The origins of this choreographic structure draw upon research mirroring natural systems in computation (e.g. Cellular Automata [12], Boid Systems and flocking behavior [13], etc.) By creating the movement logic in this way, the structural underpinnings of the choreography is based in a translational language. This work differs from many movement-system collaborations in that the approach does not begin with a technological system given to the dancers to work within, nor does it capture the dance movement and reflect it back in performance.

This approach creates, in effect, programmed human agents of a non-computational system. In a strategy towards expression, intuition and flow in the dance, performers here work with numbers and spatial cues rather than psychological or emotional sources to guide the composition of their individual movements. The counting becomes a variable incremented while the decisions become productions of a function executing. While reductive, the comparison is useful to explain the manner in which narrative emerges during this performance. The underlying algorithm is responsible for an emergent, dynamic, improvisation,, and the accumulated pattern it produces becomes the narrative. The manner in which the performers react and respond to the algorithm and coordinate with one another, results in intention, story, emotion and psychology.

A key facet of the emergence is the reciprocal actions between performers on stage. Innately able to predict circumstances that may unfold and to read and respond to one another, they are able to adapt the rules to present circumstance and desired intent. Scaffolding on top of the foundation, they build new logics to evolve interplays between proximal counterparts. This is particularly important to the authenticity of the choreography, as it is in many ways revealed through the human response to a structured algorithm.

The nature of this heuristic logic approach also leaves it open to a series of computational interventions with potential to explore reciprocities between computation and performance. Next we develop a deeper exploration of how such interventions can be used in performance.

Figure 3. 36 Walk 'Algorithm'

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36 Anthem Rules [excerpt]
1. Walking - Change direction on 1
             90-degree angles, Wandering
2. Changes in tempo – slow or running
3. Pauses
4. Holding Hands
5. Holding Hands into small weight share
6. Exit at any time, only enter on the 1

36 Anthem
Line 3: 3 3 2 2 2 3 3 3 3 4 4 4
Line 4: 3 2 2 2 3 3 3 3 2 2 2 3 3 3
Line 1: 4 4 4 3 3 3 3 2 2 2 3 3
Line 2: 3 3 3 2 2 2 3 3 3 3 2 2 2 3
Chorus Decent: 8 7 6 5 4 3 2 1 8 7 6 5 4 3 2 1
Chorus 6s: 6 6 6 6 6 6 6 6 6 6 6 6
Chorus Final: 6 3 3 6 3 3 6 3 3 6 3 3 6 3 3 6 3 3
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5. EARLY COMPUTATIONAL MODELS

Following the development of '36 Walk' at the initial design residency, the project's design and research team began to explore strategies for augmenting the emergent dance piece with computational agents for performance. The motivation for this was that through emergent computation multimedia, a richer evocation of the underlying concepts behind the sequence could be developed and a deeper relationship to the broader narrative fostered. Two explorations of 'visual décor' to support the exposition for the piece were conducted are next described. Subsequently, we critique the limitations of these tools and describe how they serve as a starting point in moving towards more reciprocal technology-performer relationships.

The first example translates the notion of an unfolded spatial narrative found in the movement qualities for the piece but extended to explore a variety of scales and granularities (see Figure 4.) Designed to explore the transitional space between urban and 'country' or desert environments, the lightweight ruleset of *'36 Walk'* introduces a series of movement

characteristics. These characteristics are applied in a 'boid system' where each virtual agent is assigned a movement characteristic, and a scale of operation. They are represented on a 2d plane designed to convey a desert/urban landscape, with the urban core simulated in the central region. In the context of this digital landscape, movement is represented at differing scales, for example: from the insect or animal scale movement; to human scale movement; to traffic, and beyond. Additionally, movement characteristics can change as the virtual agent transitions between simulated 'regions' of natural and urban land, further underpinning concepts central to the piece. Finally, this relatively unsophisticated emergent system offered potential to explore multiplicities of movement at a scale that the physical constraints of performance would not support. This connected directly to a premise within the broader performance of the tribe. Movement within the simulation leave traces that then slowly fade, designed to illustrate the ambulatory narrative over time. This representation was designed to support the performed sequence, supporting a viewer in understanding and intuiting the performance at it unfolds in real space while providing evocative proxies to the central concepts. However, its limitations are clear as it is decoupled from physical kinesthetic manifestations within the space and serves as a mere illustrative backdrop for the human performance of the piece. Nevertheless, it highlights potential usefulness of the digital to extend the in-situ performance of *'36 Walk'* in interesting ways; to extend the physical plane into a virtual landscape; to provide digital agents which can perform the sequence at different granular movement scales; and to offer a large number of digital performers which can accompany the live dancers in real-time.

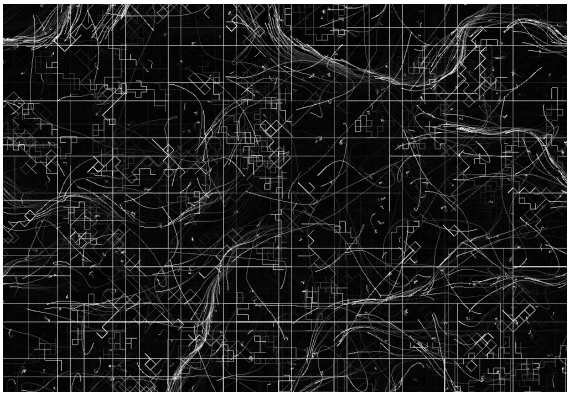

Figure 4. Visual Exploration of Movement

The second exploration (see Fig. 5), considered a closer coupling of the physical space with the digital by creating a single virtual agent to move in tandem with performers in the real space. Designed to be made manifest on the stage through floor projections, the actions of the digital agent may now lightly 'interact' with performers in real space. The agent is assigned a 'part', and maintains the same counting structure along with the performers, making iterative decisions at each point. Overlaid on the performance space, the performers may then respond to the movements of the virtual system making, decisions to follow or avoid their digital counterpart as they might any other dancer in the space. The same ruleset is used to generate the choreography of a virtual agent as it navigates the virtual 2D space. Depicted in Fig 5, the lighter polygons represent the pathway and trajectories of a virtual performer. It has the same behaviors as a real performer (e.g. holding counts; pausing in place; leaving the performance space; making iterative decisions, etc.) but has no live sensing of real-time activity. Much as the previous example, it leaves a decaying whiter trail providing a visual 'narrative' of its movement. This results in a bounded virtual generative design that offers a computational interpretation of the movement algorithm.

While both of these approaches extend the kinesthetic logic found within the rules of *36 Walk* to a virtual model, they also have some clear limitations. First, they do not fully capitalize on the potential for deep integration between human and computational performance that the algorithmic sequence offers. Both currently are more akin to 'visual décor' and do not connect to the performer or embody digital 'movement' fully in the space. Moreover, as a potentially strong visual presence within the performance space they would likely draws attention away from the kinematic movement, rather than harmonizing with it. The aesthetic and technical limitations of these implementations run the risk of them becoming a poor backdrop for the performance, rather than fully supporting the intent and narrative of the performance. Consequently, we motivate a need for an interactive generative model that realizes 'Post Choreography' thinking [16] towards greater aesthetic, symbolic and technical ends.

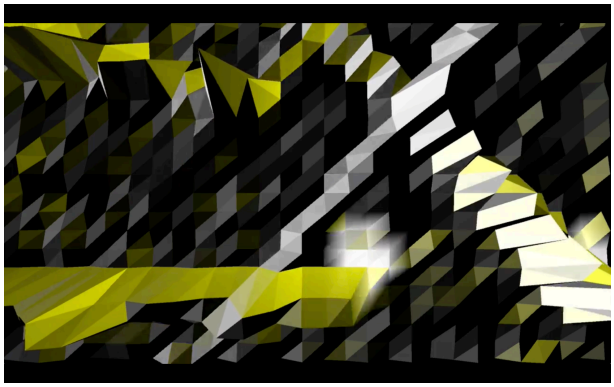

Figure 5. Emergent Virtual Agent for Floor Projection

6. NEXT STEPS / NEW RECIPROCITIES

Highlighted above, '*36 Walk'* has both synergies and dissonances with computational approaches and this leads us to consider how we might couple movement and media more coherently. It also highlights a new opportunity space for movement and computation. Towards this we are now preparing an experimental platform for movement and computation which embraces the emergent characteristics observed in *'36 Walk'*. This will be realized as a responsive performance environment where performer activity will be captured and expressed through real-time motion capture data. A virtual model will establish a 'landscape' where interactive agents and live performers can be coordinated. Multimedia projection and interactive lighting will make the virtual agents manifest within the space and support improvised interaction, dynamic permutations, and an unfolding narrative led equally by technology and performer. Our goal is to couple approaches in 'visual décor' with 'gestural expression' in a coordinated responsive, and spatialized environment for media performance that will deliver an integrated framework which capitalizes on the opportunities for dynamic improvised performance present in both. Within this model, and similarly to Rowe [16], we seek to approach computer and performer as equal partners and as individuated, reciprocating agents operating in the same performance environment.

While a dynamic relationship certainly exists between performer and machine, the machine is largely a manipulable instrument in service of the performer. It is an *agent* manipulated by an *actor* to evoke some form of expressive representations within the space. Within our approach, we seek to develop reciprocal relationships between performer and computer where neither is agent or actor [16].

The reciprocity between performers within '*36 Walk'* is what makes it particularly interesting. A product of the rule space and the procedural approach, human interactions accumulate to yield the narrative presented to the audience. The choices accumulate and coalesce into the story that is told. There are points where the dancers can choose to interact with one another, ignore one another, to repel, attract, or avoid. Equally, a virtual agent should have the same opportunities within the choreography: to attend or ignore, to cue or to lead. This would allow for a natural progression and a clear integration of both 'systems' found within the performance landscape.

Raising the question of what the computational agent does within that scenario; *How does it make those choices and how does it show its actions within the space? How does it intervene in choices the dancers might make? How does it acknowledge the dancers as it moves through the grid?*

These questions ask what is the 'form' for this computational 'movement'. Similarly, to the dancers, we draw on emergent structures to drive the computational agent, however, the appropriate means by which it is evoked within the space is the critical concern. Our expectation is that the most effective computational system is the one where by the performers can distinguish it as an enactive system, not primarily to make 'more legible' the meanings within the dance, for the benefit or spectacle of the watching public. Distinct from other systems, it will not offer an outpouring of media but a subtle, embedded and embodied presence within the space - collaborative and competitive, but in sync with the performance.

We acknowledge that questions raised for performance and dance, are not often the questions which come up for engineering and interaction design. Our solution is to approach this as an integrative exercise whereby movement and computation are considered in tandem. In so doing, the algorithm and the practice can adapt together and to one another. By designing for *mutually satisfying* strategies for expression through the framework of a 'score' for improvisation - we look to allow emergent patterns between performers and virtual agents to discover new narratives and unexpected expressivity.

7. CONCLUSIONS

In this paper we have presented a case study of an exploration of hybrid interactions of tactical bodies as a means to ask how kinesthetic and computational systems might be brought into closer alignment with one another. Using an algorithmic approach to choreography, this score generates an unfolding narrative through the accumulation of performer-performer interactions in response to this rule set. We reflect on the development of this work to consider new forms of media arts for dance, which is not based on the computer as representational system. Leveraging insights from this exercise, we critique our early work in developing computational performance environments for this score. Highlighting a need for deeper coordination between performer and computational agent, we now seek to develop emergent computational structures that will allow for reciprocal performer-technology relationships to develop.

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