

Creativity in AI Dance Art

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Abstract

In this short essay I consider some of the ways creativity is embodied in the processes that dancers rely on to produce their art, and then reflects on what this means for AI Dance art. To do this I draw on Margaret Boden's original (1998) approach to creativity in AI, and its distinction in three kinds of creativity; combinatorial, exploratory, and transformative. I discuss how each of these manifest in dance, and what routes or challenges there are to making AI approximations of those kinds of dance creativity. Finally, I articulate how this points to a distinctive aesthetic value that attached to dance art produced by humans but not AI.

Keywords

Creativity, Dance, AI, Embodiment

In this short essay I consider some of the ways creativity is embodied in the processes that dancers rely on to produce their art, and I reflect on what this means for AI Dance art. Creativity can be seen as on of several important cognitive dimensions of dance to which ongoing scientific investigations are dedicated because, in short, we have room to understand it much better [1]. A Dancer can be creative in many ways, and to account for these comprehensively is more than I can hope to achieve in this short piece [2]. Instead I will employ an existing approach to creativity in AI, authored by Margaret Boden [3], and apply it to dance. Boden's account helps reveal what makes some creative processes more or less replicable by artificial means, and characterizes the extent of current progress and possibilities for creating AI that exhibit human-like creativity. Her work concerns human-like creativity in general, and considers a variety of examples, including many in linguistic and visual task domains. The application of this view to dance is interesting partly because of some of the ways dance differs from most domains in which AIs are assessed. In particular, the norms in this case are aesthetic and the essential achievements or "outputs" have to be understood in terms of the moving body. Perhaps it can provide a helpful new perspective to bring this conception of creativity for AI into such a domain of activity.

I rely primarily on philosophical methods of critical analysis and on my experience as a dancer in order to flesh out this Boden-based view of creativity in dance. Doing so will allow me to highlight a deep distinction in how one kind of creativity manifests in AI- as opposed to human-dance art. This difference, I suggest, grounds a distinctive aesthetic valuation of features

ICCC'22 Workshop: *The Role of Embodiment in the Perception of Human Artificial Creativity*, June 27–28, 2022, Bozen, Italy

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 CEUR Workshop Proceedings (CEUR-WS.org)

of dance art that no AI yet achieves.

I want to note at the outset that dance is very often a social phenomenon, and certain aspects of dance creativity are themselves social [4], but I will not be discussing these aspects here; my scope is limited to the evaluation of one dancer at a time. If my ideas are helpful for understanding creativity in AI-Dance in the non-social case, they may be helpful for thinking about collective creativity as well. So the question at hand might be restated, in short, as being “How is creativity embodied in the processes that an individual dancer relies on in the production of their works?”

Boden begins her article by saying “Creativity is a fundamental feature of human intelligence, and an inescapable challenge for AI,” and adds that creativity “is grounded in everyday capacities such as the association of ideas, reminding, perception, analogical thinking, searching a structured problem-space, and reflective self-criticism.” As Boden describes, AI researchers would like to approximate human-like capacities for creatively coming up with new ideas. One might like to develop algorithmic approaches that capture something crucial in the way people manage to generate novel ideas in mathematics or music, for example. Boden provides for a clearer sense of this goal and our progress toward it through this article’s account of creativity. One thing she notes is that creativity in humans seems connected to emotion and motivation in a way that is often ignored by research on AI creativity. The thoroughly emotional nature of dance is one reason to think it is a helpful domain for examining some aspects of intelligence and creativity that have been studied the least.

To discuss creativity in dance generally, one meets the difficult task of finding some way to usefully categorize different parts of a dance across all styles. Any conception of individual “moves” or “parts” deriving from one style may be biased against others, or make it impossible to describe certain forms of creativity in those other styles. A dance performance might be creative as a whole, or a particular movement sequence may be creative, or an aspect of part or all of the performance might be creative - say, how it uses different parts of the stage, or how it represents certain rhythms or sounds in movement. I cannot take the space required to develop a style-agnostic ontology of dance elements, but it will be helpful to have a term, even if it is quite broad, to refer to any part of any dance that a human or AI might perform. I’ll use the term “moveme” for this purpose (partly inspired by Datta et al. [5], though my use differs somewhat). Boden speaks of creatively generating novel ideas, and considers examples like producing a new joke of a certain form, or a new architectural design under certain environmental constraints. A moveme is an analogous construct specific to the production of dance works. A moveme could be a specific movement of a limb, or of the whole body, or a sequence of such movements. A moveme could also be a subtle quality of movement, an aspect of musicality, a conventional sign, or a gesture mimicking some act or event. Movemes can vary enormously from one another, which is necessary for the descriptive role they play here. The creativity of a dance can thus be described as a matter of the novelty of the movemes a dancer uses, and under which circumstances and in what order.

One helpful distinction Boden makes is between ideas that are novel with respect to an individual person or artificial system, and those that are novel with respect to an entire cultural collection of such ideas. The former exhibit what she calls psychological-creativity, whereas the latter exhibit historical-creativity. In the present context we can think of this as the difference between novelty for a dancer and novelty for a dance style (or styles). As a result of a dancer’s

experience of many rehearsals and exercises, some set of movemes is relatively well known or habitual for that dancer. These are movemes that the dancer can execute smoothly and reliably, needing only a simple verbal prompt or a partial demonstration, rather than needing to see the moveme actually performed. Movemes that are the most well known are those that are most likely to immediately occur to the dancer as possibilities in the course of improvisation. For a dancer to be creative in the psychological sense then, they must be able to somehow appropriately incorporate movemes that are not well known or habitual for them. The history of a dance style comprises, among other things, a set of conventional movemes and norms about the conditions of their use. For a dancer to be creative in the historical sense, they must break or go beyond conventional moveme usage. One might be interested in AI-dancer that is creative in either sense; one that can expand its own range of movemes, or one that can come up with movemes that transcend conventions of current dance styles.

The core of Boden's analysis is a three-way distinction between combinatorial, exploratory, and transformative creativity (which crosscuts the distinction between psychological and historical kinds of creativity). I will discuss some of the ways these varieties of creativity manifest in dance, and reflect on the possibilities for building each into an artificial dancer.

Combinatorial creativity is straightforward here; a dancer can find a novel way to put together two or more movemes. For a simple example, a dancer might at one time be readily able to perform a spin and also able to raise their arms to the sky, and then exhibit creativity in putting the two movements together for the first time. Insofar as a range of movemes can be approximately generated in a virtual character or a robot, combining movemes in novel ways in such an artificial body should be feasible. The programmers or engineers could find novel ways to modify the parameters of the processes producing that body's movement, or might even develop generative processes within the AI for combining movemes in novel ways (at random, for instance) [6].

To think about Boden's remaining two kinds of creativity in the context of dance - exploratory and transformative creativity - we first need to have a dance-specific sense of "structured conceptual spaces" that Boden describes as to-be-explored or -transformed. For example, suppose a choreographer is creating two minutes of choreography for a twenty-by-sixteen-foot stage to an upbeat hip-hop song with thematic elements of strength and pride. Assuming the choreographer does not re-use an extended sequence from another piece, or copy someone else's choreography, they will likely proceed by exploring the range of movemes with which they are competent that seem to fit aesthetic criteria of the genre, the performance context, and the music. The choreographer thus explores sub-space of the overall space of movemes available to them, where this sub-space is structured by specific choreographic needs. Further, as soon as the choreographer has settled on one or more movements, this imposes a high degree of structure on the space that the proceeding movements might occupy. In general, the dimensions of the relevant space for exploration and transformation can be given by a dancer's possibilities for executing different kinds of movemes, the constraints of a particular dance style, and any number of additional features of the context of creating part of a dance work, like stage setting or music. Every movement in a performance can be theoretically represented by the region of this moveme-space that it occupies. Exploratory creativity in dance is here envisioned as entering into new regions of a moveme space. For example, if the choreographer imagined above has never or rarely worked with hip-hop music before, the constraints on this space

provided by the music may render some familiar movemes inapt, and facilitate transitions to movemes in previously unexplored parts of the space.

It requires extensive training for a dancer to be able to access many parts of such a space. This training provides a greater range of “movement” through this space and also makes it easier and harder for the dancer to occupy certain regions, or easier or harder to “move” between certain regions. To be clear, the “movement” here refers to transitions between moveme-complexes, not to the physical movements of the dancer’s body that these complexes abstractly represent. So for example, as one learns a dance style where one’s center of mass maintains an up-and-down pattern of motion, one might begin to struggle with sequences of movement that keep a level center of mass. In other words one may be trained so as to tend to bounce to the rhythm by default, making long, bounce-less sequences difficult, which can be described as harder-to-reach places and paths in moveme-space. This occurs as certain techniques for maintaining control or for meeting certain aesthetic aims are learned to the point that they can be implemented quickly, smoothly, and robustly. This change may have to do with the speed of our conscious, deliberative thoughts, since the acquisition of expertise is often marked by loss of phenomenology of deliberation about common aspects of movement. This is not to say that these aspects of movement become thoughtless or unnoticable. The idea is rather that these movemes are deeply ingrained and can be performed more or less subconsciously as a result of extensive, deliberate and motivated practice. This history of practice separates the expert from the novice, both in their dancing and their perception of it [7].

The effects that dance training has on “movement” through this space is especially important here because it pertains to differences in what creativity looks like in human as compared to AI dance art - especially transformative creativity. Transforming the space of movemes associated with the production of a dance work means the artist somehow adds to, subdivides, or otherwise alters the kinds of movemes that characterize the dimensions of the space. One way for a dancer to achieve such a transformation is to recognize and counteract some of the movemes that are common in one’s training history or in the stylistic context. These movemes presumably are some of the most deeply ingrained, so this transformation requires a sensitivity in awareness to aspects of one’s bodily movement that are often subconscious, and requires effort be directed against long-habituated patterns of movement [8]. In some cases, transformative creativity can arise quite suddenly and somewhat inexplicably. Perhaps some inscrutable feature of the dancer’s recent experience allows them to envision some new form of movement, or some critical threshold is reached in a slow and mostly hidden developmental process and suddenly - aha! - a transformation of moveme possibilities occurs. One can see the transformation as analogous to the jumps that can happen in a standard learning process; one may practice the “foundations” - the most common movemes for a style - until they become so intuitive that possibilities suddenly open up for relating them to other movemes in complex and musical ways.

For an AI dance piece involving either a virtual body or a robot, the moveme space must depend on some codebase and numerous implementation details governing the movement possibilities for that body. Exploring not-yet-performed parts of that space could occur somewhat as described above, only where the path from cognition about a new moveme to performing it must be extensively mediated by human-engineered code and hardware. An artificial dancer could be designed with a goal structure and an environment such that it could explore its moveme space,

but this would require state-of-the-art machine learning techniques involving large models and substantial computational resources. If such an autonomously creative AI dancer were made, it might be likely to explore movements that human dancers find unnatural or unaesthetic.

Transformative creativity for AI dance art could come from human-engineered alterations to the AI's architecture, or as a result of learning-driven changes to network functioning. An added consideration here is that the normal physical bounds on the human body are themselves artificial in the context of AI-dance art. An AI dancer might beautifully levitate or fold down to one tenth of their size, so the range of relevant movement spaces (and transformations thereof) is in a sense much larger for AI dance. However, in the kinds of systems prevalent today, transforming an AI's movement space would have to occur via changes that happen outside of the context of the AI's dance activity. That is, AI are typically trained on tasks whose important categories and relationships are fixed, and trained on data taken to be representative indefinitely into the future, rather than learning continuously and in preparation for important contextual changes [9]. Further, transformative creativity for current AI does not involve a responsiveness to aspects of movement that have become deeply ingrained in a dancer through intentional practice. AI dancers today are incapable of transforming themselves through further practice or experience. Perhaps an autonomously creative AI dancer could exhibit transformation in the course of its activity, but at present this is still science fiction. All of this points to a deep difference in how creativity manifests in the production of human as opposed to AI dance art. In particular, for the human dancer, transformative creativity is linked to that dancer's possibilities for self-awareness and self-modification through practice.

Acknowledgments

Thank you to the organizers of this ICCC workshop, and to the University of Pennsylvania Office of the Vice Provost for Research for making this work possible.

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