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"I dwell in possibility"
Emily Dickinson

DANCR-tool; an AI and more for improvisation and choreography

(Extended video transcript to the docu clip on the DANCR-tool)

Oliver Schürer

00:00

Movement is expression and communication, but it is also change and transformation. Your movement is your interaction. When the interaction is smooth, you feel it, it's a flow with the other. Or, to put it another way, being in flow with someone is like improvising dance.

To open the door for humans to improvise contemporary dance with AI, we developed the DANCR-tool.

We are Haus, short for H.A.U.S., a transdisciplinary group of researchers from AI, architecture, choreography, dance, human-robot interaction, media arts, music, and philosophy doing arts-based research.

But dance and AI are pretty alien to one another: How can we achieve improvisation between dance and AI – between body and logic, between the spatial and the statistical, the aesthetic and the abstract?

To answer that question, we went to the AI lab and on stage, in either case, dancing.

By means of researching and developing, we realized our DANCR-tool.

We decided to work with a humanoid robot. Because having dance depicted on a flat screen is just too limiting. Other than screens, which are just windows onto some two-dimensional media, a robot is in the room with you, together. Of course, a robot is way more complicated and costly to work with, but it's worth

the effort. The robot allows you to observe any motion from every angle and to move along with it in space. The robot gives you a gaze, and you can hear, smell, and touch it.

But with that goal, we faced a challenge: would it be possible to make a humanoid robot track a human dancing partner and express itself, both in real-time?

1:39 **Angle-Space-Algorithm**

The body of any dancing person is very different from the body of a humanoid robot. Not only do the body proportions differ, but also the range and speed differ significantly. We had to translate the movements of the dancer's body into the motions of the robot's body. Dancer's movements are tracked by a sensor system.

It took a PhD to develop our Angle-Space-System. An algorithm that describes the positions of human body parts by angles in space to control the robot's body parts to allow for the immediate expression of human movements by the robot. Now it enables the translation of the movements of the dancer's body into the motion of the robot's body. Thanks to our Angle-Space-System, our robot is now capable of imitating human body expressions to the most general extent. This opens up the full potential of the robot's interactive potential.

When you dance with this algorithm, the robot enacts a hybrid entity of yourself and itself, of human-AI perception and body kinetics, composed in real-time. Your movements control the degree of hybridity and the rhythm of hybridization. That gives you a deep sense of synchronization with the humanoid.

2:42 **Imitation and variation**

By working with the tempo of the motions of the robot and the proximity to it, you drive the change between imitation and degrees of variation.

As a result, the robot enacts a hybrid entity of yourself and itself, composed in real-time. Tempo and proximity are rooted in your bodily skills to control the workings of the Angle-Space-System, to improvise with the humanoid robot. Both tempo and proximity establish a deep sense of synchronization with the humanoid felt by the human. That way, you can control the degree of hybridity and the rhythm of hybridization.

With the angle-space-system you gain access to a potential of dynamically evolving, hybrid dance material originating in both the robot controlled by the angle-space-system and yourself.

With this algorithm, you can dance with a humanoid robot in two specific phases of improvisation: imitation and variation. Those allow for sophisticated motion – great! – but this is just not enough. Could an appropriately programmed and trained AI propose the lead and the pause in a meaningful way?

Hence, we started to develop an approach for an improvisation AI that would be capable of doing that.

3:34 **improvAI**

Our approach to AI was driven by concepts at the epicenter of contemporary dance aesthetics:

movement without any explicit beginning or end,
center of gravity may shift,
body parts may follow different temporal sequences,
and the dancing body's individuality.

Could we make the movements of an individual dancer recognizable when improvised by a humanoid robot controlled by our AI?

But what is essential for contemporary dance turns out to be a tough challenge for conceptualizing our AI for full improvisation. Because, if one can't exactly tell when to start and stop – how do we describe motion that has no beginning or end for an AI dataset?

Your improvisation experiences are shaped by the entities you dance with. Their embodiment in space influences your bodily sensations and your movements. You in turn, do the same with your embodiment. During the open circulation of time, an entanglement unfolds to a spatiality of hybrid perception with hybrid body kinetics. In this space, dance does not develop from pose to pose by means of steps. Instead of linear time and static space, the entanglement unfolds a space that is made receptive to work with loops of drifting and sliding.

4:30 **Motion and space concept**

Hence, we developed a concept of motion that is not working with classical linear time and that is not made up from discrete units like steps or poses. Instead, it enables drifts and slides by conceptualizing time as an open three-fold circularity between the human and the AI-controlled robot. By that, hybrid man-machine perception and body kinetics entangle with the dancing humans' perception and kinetics. Now, improvisation here originates from the manifold relations between the different bodies' corporealities.

The motions the improvAI is generating are hugely different from the ones generated by our algorithm. That's very good!

5:28 **Leading and giving lead, as well as imitation and variation**

We introduced our algorithm to fine-tune our improvAI to produce four distinct sequences of improvisation with their transitions:

The improvAI is taking the lead, or is following you by imitation or variation, as well as establishing eye contact to signal "you first" to give you the lead.

6:23 **DANCR-tool**

We ended up with a tool developed by artists and scientists for artists, the DANCR-tool. It gives you the opportunity to produce your own data, train your own AI-models, and improvise with the improvAI.

You produce your training data yourself with the DANCR-tool. Hence, you stay in full control over your data and work sustainably in ecological as well as social terms. You store your movements in an archive and compile it according to your many different ideas and use them to train as many AI models as you wish. Besides individual models, you may want to work with others and produce AI models from all your movement data.

Choreographers and dance researchers work with the DANCR-tool to develop artistic material to derive dance art and to go on stage with it. Besides, it allows for sustainable artistic development in that it is also a dynamic archive, allowing you to share your ephemeral dance over time, to be enacted in space.

The DANCR-tool enables entanglement of dance and AI in improvisation – now you drive and control the improvisation between body and logic, between the spatial and the statistical, the aesthetic and the abstract, to do your art. The DANCR-tool invites you to break out of familiar routines, develop your potential even further, and produce and explore as yet unknown dance material.

Further references

<https://h-a-u-s.org/>

DANCR-tool at the H.A.U.S. blog:

<https://h-a-u-s.org/index.php/2023/10/31/project-dancr-and-dancr-tool-accomplished/>

DANCR-tool short video documentary at Vimeo:

<https://vimeo.com/1107098914>