Embodied Voice and AI: a Techno-Social System in Miniature

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Motivations

One of the original motivations for the practice-based research presented in this paper is rooted in the premise that embodied knowledge is relevant to the field of AI, not only in terms of application to design but also in terms of critical practice. A key proponent for integrating embodied knowledge into Human-Computer Interaction, Schiphorst (2009: 225) reckons "embodiment in the context of designing for technology" matters, and "concepts such as embodied computing and embodied interaction" require "design strategies that take advantage of our senses, accessing a richer and more fully articulated form of human being". In terms of critical practice, feminist techno science scholars such as Leurs (2017: 137) regard the researcher as an embodied subject, and stress the importance of materiality, by emphasizing the relational entanglement of bodies and infrastructures in the creation of knowledge. In her seminal book, Artificial Knowing: Gender and the Thinking Machine, Adam (2006) argues that "the body plays a crucial role in the making of knowledge". The afore-mentioned scholars draw on feminist research to counter the dominant data science discourses that still equate intelligence with rationalistic problem solving, in which claims for objectivity and universal truths propagate what feminists call, a "view from nowhere". Anthropologist Suchman (2007) in her critique of the "disembodied intelligence in AI" also points out that "feminist theorists have extensively documented the subordination, if not erasure, of the body within the Western philosophical canon", an erasure Suchman claims extends to the field of AI and Robotics.

While addressing the wide literature and theory in both application design and feminist critical practices lies outside the scope of this paper, these are the kind of perspectives that provided the original motivations for embarking on our research project. Continued research will further explore the implications of these theories for this practice-based setting. What we can do here is to acknowledge, as Suchman (2007) posits, following Haraway (1997: 11), that "technologies […] are forms of materialised figuration". They are brought into existence by assemblages of humans and

machines, bringing meaning and values, including dominant assumptions and biases that subordinate, into the process of new knowledge creation. We believe this calls for more critical introspection of one's own practice following Leurs (2017: 145) who states,

> "it is through being critically self-reflexive about one's positionality, locating research practices within wider power relations and structures, that we can begin to destabilise the normalised politics of knowledge production".

Therefore, in presenting the framework below, we aim to also reflect on the positionality and the ethics of our research, in part through revealing the individuals and the corresponding assemblages in the development of tools and processes.

Strand One: Augmentation of performative practice through an AI wearable design

This section proposes a hybrid methodological framework which discusses the technical and formal aspects of augmenting an embodied practice for actor training by means of a custom-made wearable device which gives the body a voice. The device is an interactive system that uses an Artificial Intelligence (AI)-based module to map movements to synthesised sound. Our framework draws on techniques from the fields of contemporary performance, wearable technology design, Human-Computer Interaction (HCI) and AI pipeline design.

Methodological framework

Embodied voice in post-Grotowskian practice

In the Embodied Voice and AI project, our team focused on a particular method for physical actor training chosen from the post-Grotowskian repertoire. This choice of method was motivated by many reasons. First, according to Wolford (1996), Grotowski's[1] practice, constituted as a laboratory of embodied research, and his rigorous system of actor training mirrored his fascination with science. Thus, his epistemic aims towards reproducibility of results and claims of scientific objectivity resulted in methodologically unique approaches to the embodied practice. This structured way of working, which inspired generations of practitioners, could serve as a

1 Grotowski was a Polish theatre director and theorist whose innovative approaches to theatre training involved the study of performers immediate, "organic", "animal-like" psychophysical responses to impulses where "there is no discursive mind to block immediate organic reaction, to get in the way" (Richards 2003:66) . He called the process of eradicating such blocks *via negativa* (Grotowski & Barba 2002:17).

conceptual scaffolding of the bodymind continuum suitable for a technological design. The training works by making the actor more aware of moments at which their body and mind act as one – giving them, through the process of repeated training, the ability to more frequently, and more deeply, access a state of "freedom from the time-lapse between inner impulse and outer reaction in such a way that the impulse is already an outer reaction" (Grotowski & Barba 2002: 16). Voice and singing are important parts of this process.

Embodied voice training in post-Grotowskian practice seeks to express deep psychophysical states through voice, in moment-to-moment situations in relation to self and to partners. Thus, "performers are trained to 'experience the body as music, as a melodic and rhythmical vibration' (Dowling, 2011: 248) that affects and allows one to be affected by others within musical and rhythmical structures" (Krawczyk 2021: 24). Last but not least, the choice of focusing on one post-Grotowskian technique is rooted in the first-hand experience that our team of practitioners had with this type of practice. We wanted to model a practice that we had a thorough embodied understanding of[2].

Team

AI-based systems are products of collaborative and team effort. As previously mentioned, we consider a process of reflexivity in relation to one's own practice to be an integral part of our research framework and a necessary step toward an ethical guideline for AI research. In this regard, we take from Leurs (2017: 139) the principle of an "ethics of care", which is described as "value-based" and cognisant of "the dependencies, partiality, political commitments and personal involvements of researchers". Therefore, we believe that awareness about the process of research, development and decision making starts with the team. In a small team and project like ours with its focus on augmenting a pre-existing psychophysical training method, it is easier to explore the ecologies of skills, knowledge, but also experience, subjective preferences, interests and embodied abilities, which the practitioners and researchers bring to the room. Together, these create a distinctive ontology of practice for the enacted "assemblages of doings" (Leeker 2017: 13) – in which body datafication, while a core focus of the research, is undertaken in an iterative way – that opens space in a process for the kind of reflexivity we propose could be valuably undertaken in other practice contexts.

2 The framework presented here is a continuation of a growing body of collaborative work established in two previous projects, The Shape of Things to Come (2019) – https://replica.institute/ (accessed 12 Dec. 2022) – and Dancing at the Edge of the World (2020) – https://berlin-open-lab.org/portfolio/dancing-at-the-end-of-the-world/ (accessed 12 Dec. 2022), https://www.hybrid-plattform.org/forschung/detail?tx_news_pi1%5Bnews%5D=996&cHash=18878ad6e067104b2e55c31756756b28 (accessed 12 Dec. 2022).

For this practice-based research, our team consisted of the following five scholars / practitioners, who are also the co-authors of this paper. Each member of the team assumed one or more specific roles within the research: Kate Ryan – performer; Mika Satomi – wearable technology and interaction designer; Diana Serbanescu[3] – artistic director, and project lead; Scott DeLahunta – ethnographer; Ilona Krawczyk – post-Grotowskian practitioner, and external expert consultant.

Suchman (2017) posits that "when we ascribe skills to a person […] the person acts as a symbol". However, she also discusses how the activation of skills is dependent on the team configuration. In relation to this, Ilona Krawczyk notices how the activation of skills in our team was supported and encouraged, through feedback sessions embedded in the process:

> What I found particularly important was how Kate and her process stood out in the first place. In the post-Grotowskian theatre this is not common, as the director's perspective on the training or performance devising process dominates the performer's perspective.

With regards to the ethics of practice, and related to a process of self-reflexion, Ilona comments:

> From the perspective of my research on ethical considerations in theatre practice, another significant aspect of this project is the effort to attentively investigate what kind of knowledge we are producing, in what areas within and beyond performance, training and AI, how the process of knowledge production is distributed among all the participants and how we acknowledge each other's contributions.

As a tool for collaborative post-reflection on the process, we used a web-based annotation platform developed by Motion Bank in Mainz.[4] This platform supports dialogue and documentation of process from multiple perspectives, allowing us to partially trace decisions and members' contributions. What our documentation reveals is that there are also aspects of tacit and embodied knowledge that each of us contributed, sometimes beyond the "traditional" roles in the team.

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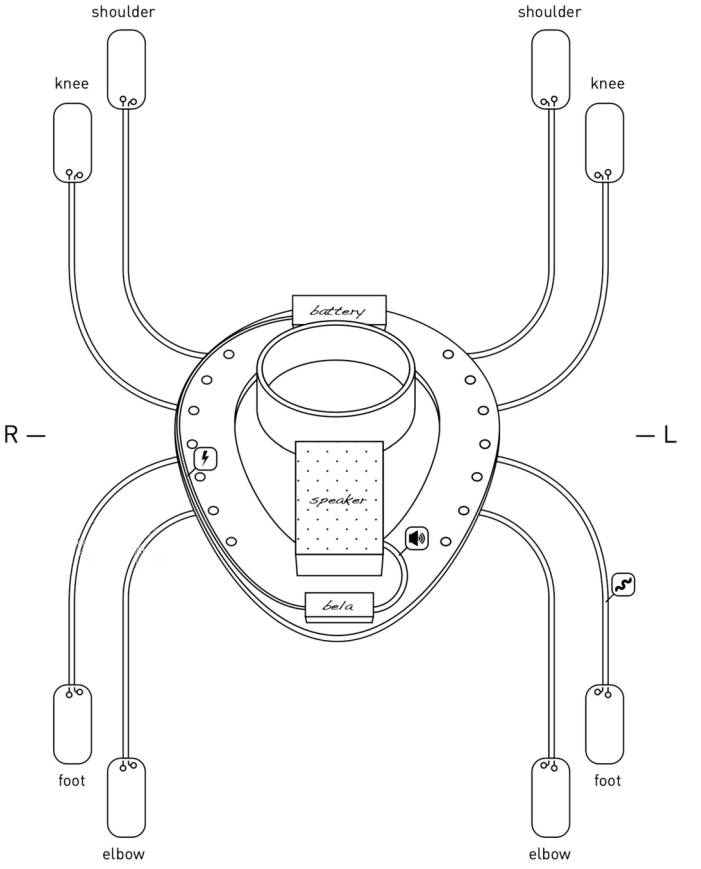
3 As the project lead and artistic director of this project, as well as the two preceding projects – "The Shape of Things to Come" (2019) and "Dancing at the Edge of the World" (2020) – Diana Serbanescu made key decisions in shaping the research framework and agenda. She was responsible for selecting team members in all three project configurations and contributed to design decisions regarding the structural and functional elements of the AI-based technological artifact.

4 Motion Bank. Hochschule Mainz University of Applied Sciences. https://medium.com/motion-bank (accessed 12 Dec. 2022).

The AI-based motion capture wearable device

Fig. 1: Wearable design by Mika Satomi. Credit: Mika Satomi



The idea[5] of imagining the body as music, as rhythmic vibration, inspired our first prototype[6], an AI-based wearable device that sonifies movement by mapping body postures to sound cues. The practice-based research discussed here builds on this earlier prototype[7] designed by Mika Satomi, and aims to alter it to meaning-

5 Ditte Berkley, a post-Grotowskian practitioner involved in "The Shape of Things to Come" (2019), encouraged the performers to "sing with the body and dance with the voice".

6 The initial prototype was developed for a performance, titled Dancing at the Edge of the World (2020).

7 In this version of the prototype, the focus was on giving a voice to the collective body of six performers by endowing each actor with an AI-based wearable device that uses movement

fully augment a specific exercise, taken from the post-Grotowskian embodied voice training.

Figure 1 shows a schematic representation of the custom-made AI-based wearable device designed by Mika Satomi. The device is a collar, endowed with bend sensors[8] that can be attached to eight points on the body, able to accomplish the function of motion-capture[9]. At the back of each collar there is a Bela board, which acts as a processing unit. All the computational process: data capture, posture recognition and mapping through a machine learning (ML)[10] module, sound synthesis[11] happen locally on the Bela board contained in each collar[12]. The ML module is based on ml-lib[13], a library of machine learning externals for Max and Pure Data, built for the Gesture Recognition Toolkit by Nick Gillian. A speaker sits on the front of the collar, emitting sounds that can react to the position of the sensors, on how the performer moves their body.

The ML model is trained on incoming real-time data from the sensors placed on Kate's body. The data from the sensors is captured in specific poses, which are devised according to our movement framework and agreed upon collaboratively by Kate Ryan and Diana Serbanescu. These data points are then mapped to parameters from the synthesizer. Due to the fact that every time Kate is wearing the collar, there are small alterations in the placement of the sensors on her body, the training process needs to be performed anew at the beginning of each rehearsal-session. During the rehearsal, the stretch of the material and consequently the resistance of the conductive fabric is also slightly altered, introducing small variations in the data and compromising the accuracy of the mappings. To counter this, the system needs to

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to trigger sound. The mappings of the ealy prototype were simple, connecting randomly devised postures to sound cues: synthesised vowels, or pre-recorded voice samples of the performers singing.

8 E-textile bend sensors made as flexible tapes.

9 By capturing the bending motion of the body part on which the sensor is placed.

10 More specifically, the sensor data is read and processed by the Pure Data (PD) (https://puredata.info/ – accessed 12 Dec. 2022) software running on the Bela board attached to each collar. This software installed on each Bela board also contains a ML-based module, which is used for mapping body postures to synthesised voice sound. The captured sensor data goes through this ML-based processing module which extends an "ml.lib" (https://github.com/irllabs/ml-lib – accessed 12 Dec. 2022) external object based on the Gesture Recognition Toolkit (https://www.media.mit.edu/projects/gesture-recognition-toolkit/overview/ – accessed 12 Dec. 2022).

11 This processing module is trained to recognize patterns of body postures, which are then used to control synthesizer parameter within the Pure Data patch.

12 The synthesised voice sound is played back from the Bela board directly to the portable speaker worn by the performer.

13 https://github.com/irllabs/ml-lib – accessed 24 May 2023.

be recalibrated and then retrained with fresh data, a process which is repeated multiple times during the rehearsals. Due to this practice of working with the variability of the textile, our data set is transient, in a continuous state of flux.

The data from the sensors can also be streamlined in real-time to a remote central unit, through a wireless network. Mika Satomi has also implemented the controller interface which enables the connection to each of the individual Bela-boards from a central laptop and is capable of visualising the sensor data in real-time and of initializing the training sequence of each system. More information about the design of the wearable device can be found on Mika Satomi's personal webpage[14].

Input: Motion capture through sensors

As previously mentioned, we limited ourselves by design[15] to work with eight e-textile bend sensors. How the sensors are placed on the body becomes very important in the customization to a particular exercise for embodied training, as we aim to capture movements on the body that are most relevant for that particular exercise. Therefore, we needed to experiment and develop a specific logic of how the sensors are placed on the body. Mika Satomi's design provides some space for flexibility and re-arrangements in sensor positioning[16]. In the context of this research, we decided to use two of the upper body sensors to be placed one on the back and one on the belly, instead of the shoulders[17]. In this updated design the lower-body sensors are embedded in a pair of pants and are following the skeletal lines of the lower part of the body.

14 https://www.nerding.at/costume-for-dancing-at-the-edge-of-the-world/ – accessed 24 May 2023.

15 The Bela board we used includes eight analog sensor inputs.

16 The bend sensors were made with kinesiology tape, often used as sport taping to retain flexibility, and they were applied directly on skin like the original tape.

17 In the original prototype (2020), we focused on sensing upper parts of the body by placing more sensors on arms: elbows and shoulders. In the first prototype there were also four distinct sensors for the legs to be placed individually on knees and feet. These were all fixed directly on the skin using glue and kinesiology tape.

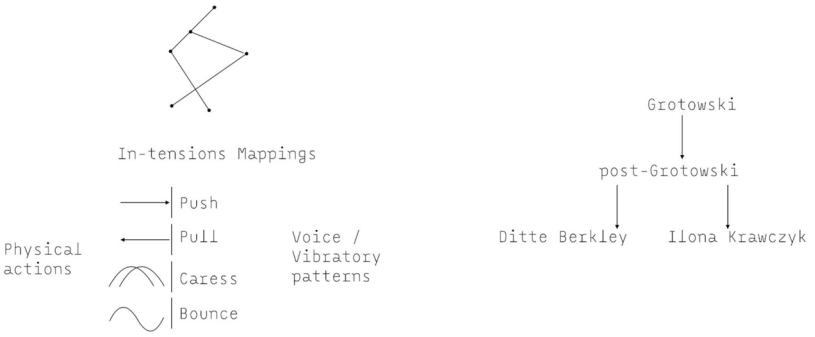
Output: Synthesised sound

The sound design is realised through patches implemented in pure data. Our prototype includes two modes – the Voder mode[18], and the Granular[19] mode – mapping body postures to synthesised sound.

Augmentation of practice: In-tensions

Gesture to sound mapping

Fig. 2: Modelling In-tensions, an embodied voice training exercise. Credit: Diana Serbanescu



Our practice-based research focuses on an exercise from the post-Grotowskian embodied voice training, which is called In-tensions[20]. The original aim of In-tensions is to transfer a physical process into the vocal quality of a performer, to improve the in-body listening (with a partner), and last but not least, to improve the vocal presence of the performer. This training system treats sound as a physical presence, as an agentive actor in space. In-tensions consists of a series of concrete physical actions. For our research we've focused on four actions: "push", "pull", "caress" and

18 This is based on formant synthesis. The algorithm is inspired by the early speech synthesiser developed by Bell Labs 1939. In this mode body postures are mapped to synthesised vowels from English language.

19 In this mode body postures control speed and playhead of the granular synthesis on prerecorded voice samples.

20 This was introduced to us by Ditte Berkley. However variations of this method exist in the practice of different other post-Grotowskian practitioners. For example, Ilona has her own personal variant of this method.

"bounce". The aim was to transfer the physical energy of these actions into the vibratory patterns of the voice.

Figure 2 shows a diagrammatic formalisation of mapping four pre-defined (embodied) actions to be delegated to selected sound cues. These actions would be performed by Kate, and the data captured by the sensors in these postures are used to train the AI-based module for classifying these actions.

An example of training the system: "push" action against the wall

This section introduces step by step the process involved in training the system to recognize and map the physical quality of performing a "push" action against a wall. At the end of the training, the pre-recorded sound cues are activated by the movements of the performer in a session of improvised responses to the task of playing with variations of the "push" action against the wall.

Fig. 3: Kate performs an action of "push" at the wall.

Step One: Marking a "push" action

Figure 3 captures Kate engaged in the process of searching for her optimal voice quality while performing the action of "push" against the wall. Originally, this is an exercise devised by Ditte Berkley. Its intention is to give a real obstacle – the wall – for the performer to engage with in order to execute an authentic "push" action, by contracting the muscles of the body that would also help with the release of the voice. The performer is encouraged to cultivate awareness in listening to their own voice, while in action, and to assess the moment of their best perceived vocal quality. Thus,

when Kate identifies the peak moment of her voice and the position in which it happens, she is instructed to tap the wall with her hand, while maintaining the posture. Diana suggested to use this tapping as a cue for Mika to start recording the incoming data from the sensors[21]. The process involves an act of precise synchronisation between Mika, operating the interface, and Kate, performing the action. The sensor data captured here will be used as training data samples for the ML-based module. The intention is to use the data that represents a moment of full embodied unity between vocal and physical quality of the performance.

Step Two: Explore "push" action mapped to sound

After the training by examples, our ML model has now learned to map the incoming sensor data with corresponding parameters for voice synthesis. The parameters for voice synthesis are experimentally chosen by Mika. At this stage, they vary from training to training. The intention is to also explore qualities of voice synthesis[22] that resemble the real voice of the performer engaged in action. Diana asks Kate to explore different types of "push" actions against the wall, and test what the system has learned and how it reacts to variations from the training samples.

Task-based improvisation with all actions

Task-based improvisations are sessions of varying lengths, lasting between one and two hours, with the aim of exploring the limitations and possibilities opened by augmenting the In-tensions practice. This is based on the embodied listening between Kate, as performer / practitioner and the AI-based system, through the wearable device. The intention is to observe how this engagement with the AI-based system could become conducive to moments of flow, or how it stimulates in-the-moment awareness in the performer.

The session is structured in two parts: the part in which we are training the system, followed by a structured improvisation. Diana guides Kate through these two phases, and she describes this process as follows:

> We are working with four actions: push, pull, caress and bounce. I ask Kate to take a moment and imagine in great detail a real context in which she would perform each of these actions, then I ask her to perform each action, in her imaginary context, as accurately as possible. After a first enactment of each precisely

21 This is the pressure applied on the resistive material representing by the stretch and fold/bend of the sensors, as activated by the muscles, and posture of the body engaged in that particular pose.

22 In Granular mode, the pre-recorded voice samples of the performer, while embodying these actions, were transferred into the system and mapped to her corresponding body postures while doing the actions. In Voder mode, we chose synthesised vowels that would resonate with the action.

executed action, I ask her to narrate out loudly details of the imaginary context, while performing the action. For example, she is now on a pier and she's pushing a heavy wooden crate. Next, I ask her to narrate how her body engages in this action. For example, she lifts her right hand, she engages her pelvic muscles, etc. When she's at the peak engagement with the action, I ask her to release the voice. This is the cue for Mika to start recording the data for training the system. The intention is that we achieve reproducible "push", "pull", "bounce", "caress" actions, that are accurately represented in the system.
The imaginary contexts and embodied narrations are meant as handles for Kate to accurately access that action in her body during the improvisation session. Once the system is trained with the data for all pre-defined physical actions, these postures are now mapped each one for a synthesised vowel, or each one for a synthesised vocal recording. In the guided improvisation, I instruct Kate to start simple, by going through all four actions in sequence. I suggest that she first tries to reproduce the actions as closely as possible to the training samples and become familiar with how the system reacts. Are the generated sound responses predictable? I guide her to focus both on her body and on the listening to the device. Can she control the sound? Can she create a song through her movements which is repeating the same melodical pattern?
The space in between the actions is mapped by the ML-module into spaces inbetween the pre-defined synthesised sounds. Next, I ask Kate to slowly play with variations to the initial actions, and by doing so, to discover the variations in sounds generated by the algorithm. I direct her focus of attention on listening. Can she, through movement, continuously explore the space of sound? I ask her to continuously search for sound and never for silence. Who is now in control, her or the AI? After she becomes familiar with the sound of the system I ask her to use it as a springboard for her own voice, etc. (Diana)[23]

By introducing the concept of "symbiotic gestures", Suchman (2017) notices that "humans and artefacts are mutually constituted". Observing Kate engaged in the process, we are witnessing a practice unfolding in intra-action between the human performer and the technological artefact. Kate is exploring the limits of the machine, and the machine reacts to Kate's actions. It is a continuous exploration of boundaries. From the sides, and by adjusting the parameters of this human-machine interaction, Mika is also modulating the boundaries between the human and the system. By suggesting shifts in attention focus, Diana is also altering the boundaries of this interaction. This type of experimenting explores in practice the notion that "agencies – and associated accountabilities – reside neither in us nor in our artifacts but in our intra-actions" (Suchman 2007). Scott is documenting our practice. Every session of structured improvisation ends in a reflection round.

23 Serbanescu, Diana. Personal note (Notebook). Entry from 3 Feb. 2022.

Potential for augmentation

Our augmentation of practice focused on improvisation with AI as a relational partner. We were interested in observing the psycho-physical process of the performer involved in this partnership, the way in which this mode of working engaged her affect and imagination, and whether she achieved moments of flow. We were interested in the potential of this system for training the vocal presence of the performer. Kate describes moments of her discoveries as well as some as her challenges as follows:

> For me the relationship with the sound became that – I felt like I was blessed in moments by a thick, association rich environment and then it might disappear. You saw a moment of disappearing there. Where I got disconnected would be those gaps, often.[24]

Or, later on she remarks:

> It feels like there's a strong platform of sound in this position – a well of sound – that I can trust to support a melody. You'll see it's a sudden leap into quite a dense sound environment – and there's an interval there immediately. (Kate)[25]

Kate's statements point towards an engaged relationship with the AI at imaginative level, through sound. She also comments on achieving short moments of flow. Diana, as exterior observer, also notices that:

> During a session of one and a half hours of improvisation, I can perceive an increase in Kate's presence and engagement, especially towards the end of the session.[26]

> Later on, Diana reinforces this observation with another note in the annotation system:
> Very interesting moment! This resembles very much a call and response. Kate, in this moment here, you've managed to establish a very beautiful "organicity" with the machine. It goes in the direction of a truthful partnership.[27]

24 Ryan, Kate. sessionone23FEB22.MP4.00:08:01.812.Text Annotation on Video. Motion Bank App.

25 Ryan, Kate. Sessionone23FEB22.MP4.00:08:09.575. Text Annotation on Video. Motion Bank App.

26 Serbanescu, Diana. Personal Notebook. 22 Feb.

27 Serbanescu, Diana. sessionone23FEB22.MP4.00:12:19.292. Text Annotation on Video. Motion Bank App.

Further witnesses on experiential trials of the wearable device come from Ilona, our invited embodied voice expert. She comments on her experience:

> During the lab session in Berlin in December 2021, I had a chance to wear the device myself. This experience gave me an idea of how the technology can be used as a partner in the absence of another performer, enhancing sensory awareness and providing impulses that eventually guided me towards a flow and heightened psychophysical state while listening attentively to the feedback sounds produced by the machine.[28]

Strand Two: Reflections on the studio-based work and on perceptions of the AI

During the last week of work in February, the work was documented with video recordings of the studio sessions. These were uploaded to the Motion Bank platform. We then used collaborative annotation to reflect and comment on the work that had taken place in the studio.

This had two objectives, one to reflect on the processes of developing the technology to augment the training practice as part of the design process. The second was to probe the perceptions and attitudes experienced by the team toward the AI-based system itself. Both drew primarily on questions to and responses from Kate, as the performer practitioner, whose relation to the AI system constituted the experience at the focal point of the research project. An example of the kind of question posed about her experience of the practice itself came from Ilona who wrote in the annotation: "*It would be interesting from my perspective if Kate annotated the moments of flow in the other video and reflected on the moments triggering change, any particular significant situations or moments where for example you got bored*".[29] Kate responded by annotating several instances (see figure 4) in the practice session recording with the following sequence in close succession:

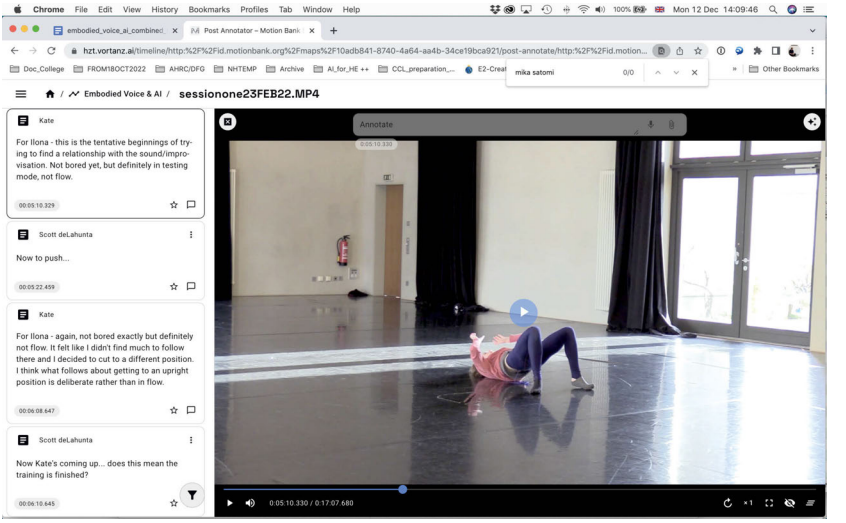
> For Ilona – this is the tentative beginnings of trying to find a relationship with the sound / improvisation. Not bored yet, but definitely in testing mode, not flow. (05:10)
> For Ilona – again, not bored exactly but definitely not flow. It felt like I didn't find much to follow there and I decided to cut to a different position. I think what follows about getting to an upright position is deliberate rather than in flow. (06:08)
> For Ilona – perhaps beginning of a little flow here! (09:38)

28 Krawczyk, Ilona. Personal Correspondence (Email). 27 Nov. 2022.

29 Krawczyk, Ilona. sessiontwo23FEB22.MP4. 05:27. Video Annotation. Motion Bank App.

> For Ilona – more flow here. (12:19)
> For Ilona – definitely flow. (12:33)
> For Ilona – I have a feeling I didn't know where to take the previous moment of flow. That I was scared of losing the connection with the sound so didn't follow it through past a certain point. (13:16)[30]

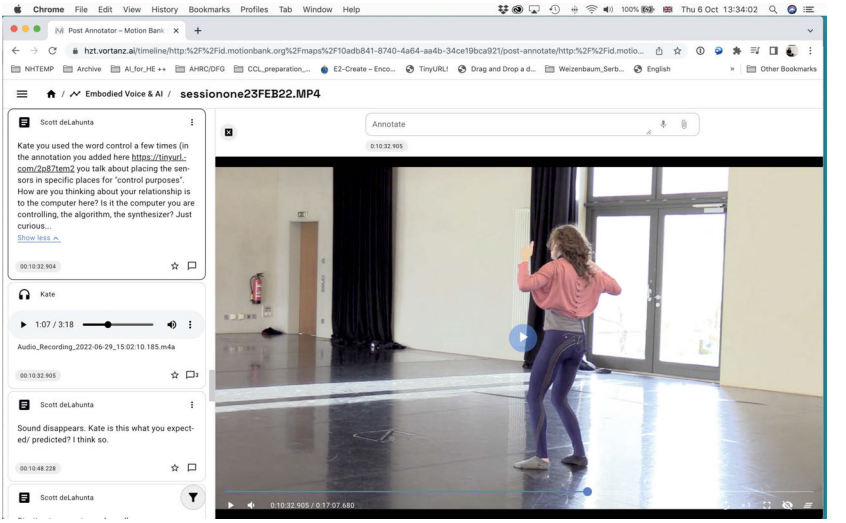
Fig. 4: A sequence of annotations by Kate Ryan about "flow". Credit: Motion Bank



In this context, Kate is reporting on the felt sense of "flow" to Ilona, who is an acknowledged expert in this form of embodied voice practice. As such, it is likely somewhat of an emic shorthand, denoting the practical knowledge of Kate and Ilona as recorded in this exchange between them. There are no references here to the AI, to the sensors or the computer, which is an interesting set up for questioning their perceptions of the AI systems. These questions tended to focus on the form of agency attributed to the AI system and explored concepts such as tools, agency, control and predictability. An example of one of these involved asking Kate about her experience of being in an embodied relationship to it. In figure 5, there is a question about 'control' and Kate has responded with an audio annotation.

30 Ryan, Kate. sessionone23FEB22.MP4. 05:10-13:16. Video Annotations. Motion Bank App.

Fig. 5: Two annotations. One written and one audio. Credit: Motion Bank



> Written [edited] annotation question:
>
> Kate you used the word control a few times, for example in another annotation you wrote about placing the sensors in specific locations for 'control purposes'. How are you thinking about the relationship to the computer here? Is it the computer you are controlling, the algorithm, the synthesizer? (scott)[31]

Audio annotation response:

> It's a very interesting question, I think I'm guilty of anthropomorphising or accepting the technology much more than everyone else in the process and have been since the beginning. I'm not thinking at all about the computer, the algorithm certainly not, the synthesiser no. My initial relationship to the sound was much more to be controlled by it. To try and control it… which is something Ilona noticed very early in the process as well. And even when I did start to get some control in terms of having some knowledge of my body, which meant I could little bit predict what would come, I think that was still the basic relationship of that interaction. (kate)[32]

Here Kate is describing an evolving relationship with the technology. It makes clear this relationship isn't any one thing, but something that changes over time, in re-

31 deLahunta, Scott. sessionone23FEB22.MP4. 10:32. Video Annotation. Motion Bank App

32 Ryan, Kate. sessionone23FEB22.MP4. 10:32. Video Annotation/ Audio. Motion Bank App

lation to the specific embodied practices involved. Kate refers to herself as "guilty" of anthropomorphising the technology. There are studies showing when people anthropomorphize AI technology this has an impact on how much they consider the AI itself to be accountable for things that happen (e.g. Epstein, et al. 2020). This has a clear implication for AI and ethics, because it calls into question whether the machine should be held accountable or those who developed it. But Kate also says she is paying no attention to the computer (also reflected in her comments on Flow), in part because her attention is directed towards her embodied practice. What is interesting is how these two forms of reflection are entwined. One concerns the (embodied) feelings of the experienced practitioner in accomplishing the task, which involves paying some kind of attention to the location of the sensors, but the sensors themselves are not the focus of attention. The fact that attention can shift here to the sensors, to the AI system and some form of agency temporarily attributed to it seems to underpin the complexity and relational fluidity that exists in these kinds of assemblages.

Conclusions and Areas of Further Research

We believe there is rich potential for future research and exploration involving the study of small-scale artistic research projects like this one (as a techno-social system in miniature) with a view toward developing and refining tools for these entwined forms of self-reflection. As previously stated, AI-based systems are products of collaborative and team effort. If these efforts are also viewed as assemblages, the question is not whether or not the same kind of self-reflective processes might apply, but how to apply them. This points toward an ethics-in-practice approach that could potentially inform the wider discussions about AI and ethics. Therefore, we call for more projects like this one to be further studied and consulted by other fields. There are other research areas that can be further developed here as well. One that our project has already begun is creating a new epistemology of practice that goes somewhat against the original ethos of the post-grotowskian training: originally this training was specific about human-to-human interaction, and embodied exchange of energy. And it is interesting to discover what changes when the machine gets involved, and what the limitations of this system are when it encounters such an established tradition of embodied practice and research.

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