Programming by Moving: Interactive Machine Learning for Embodied Interaction Design

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Interactive Machine Learning is a promising approach for designing movement interaction because it allows creators to implement even complex movement designs by simply performing them with their bodies. We introduce a new tool, InteractML and accompanying ideation method, being developed to make movement interaction design faster, adaptable and accessible to creators of varying experience and backgrounds. By closing the gap between ideation and implementation stages of designing movement interaction, we hope to apply embodied sketching all the way through the creation process, supporting the design of more expressive and reflective range of movement interaction.

CCS CONCEPTS • Human-centered computing ~ Interaction design ~ Interaction design process and methods • Applied computing ~ Arts and humanities

Additional Keywords and Phrases: Interactive machine learning, movement-based interaction design, HCI, embodied design approaches

ACM Reference Format:
First Author's Name, Initials, and Last Name, Second Author's Name, Initials, and Last Name, and Third Author's Name, Initials, and Last Name. 2018. The Title of the Paper: ACM Conference Proceedings Manuscript Submission Template: This is the subtitle of the paper, this document both explains and embodies the submission format for authors using Word. In Woodstock '18: ACM Symposium on Neural Gaze Detection, June 03–05, 2018, Woodstock, NY. ACM, New York, NY, USA, 10 pages. NOTE: This block will be automatically generated when manuscripts are processed after acceptance.

1 INTRODUCTION

As movement sensor technologies become more available, affordable and reliable, body-based interaction is now placed firmly within contemporary digital culture and the creative domain, particularly dance, interactive and immersive media [1] [2] [3] [4] [5]. Soma-design offers synergies with artists and dance practitioners working

with interactive technologies by facilitating the design of affective bodily-based interaction with emotional reflectivity [6] [7] [8] [9]. Frameworks that describe movement interactivity for performance, interactive installation or similar, highlight a standard workflow: live movement sensor data as input -> to which some sort of computational processing would occur, or mapping -> out of which an output or system response would be produced. In order to elicit engaging interactivity, movement-based acts must be paired with clear feedback from the system [1] [8] [10] [11].

An important feature of soma-design is iterative testing and feedback of sociodigital material, where a creator experiences the correspondence between their embodied action and the systems response- we stress that this feedback is important while creators are still in the design process so the pairing between movement and system response can be properly explored. We offer a new method and interactive machine learning toolkit that bridges the design process from ideation to implementation, allowing for quick cycles between embodied exploration and system feedback.

2 MOVEMENT INTERACTION DESIGN AND EMBODIED KNOWLEDGE

To accommodate the shift towards affective bodily-based interaction, there are several design approaches that exploit tacit embodied knowledge, such as those that develop movement interaction designs through physical ‘bodystorming’ or ‘embodied sketching’, by acting them out. This requires a first-person perspective on interaction design [12] and design by doing and moving [13] [14] as an early stage of the design process. Enactment in this way enables designers to reflect on the changing experience of movement over time, through this reflection the activities supports cycles of reflection and refinement [15].

We adopt the embodied sketching design approach as an ideation practice when using Interactive Machine Learning for designing embodied interaction. Following from Caramiaux et al (2015) our method uses an adapted form of the critical incident technique; a procedure that elicits designers to recall recently lived memories from their everyday lives to apply as input for design [16] [17]. Here, the method takes its form as a ‘movement incident’, where subjects are instructed to remember, from the past few days, an atypical situation in which a memorable movement contributed. This guides the designer towards their own lived experience, in line with Núñez-Pacheco and Loke’s approach of focusing, based on invoking an awareness of the felt qualities of embodied experience [18] [19]. Designers physically enact and explore their movements. Instructed to ‘slow it down, speed it up, make it as big or as small as you can. Make it go wrong’, the aim is to encourage embodied sketching and the embodied design ideation practices of using estrangement and defamiliarization as an exploratory method [8] [9]. We pose that the sense of ‘play’ in our method is in important part of the iterative approach. Play disarms the creator to take risks, to react quickly without dwelling on the outcome, we have found this enriches the process and gives rise to interesting results [20] [21].

If we are to carry on this embodied and iterative approach through to the implementation phase, we need to continue to use our body. Our second technique, Interactive Machine Learning [10], enables creators to

implement movement designs simply by performing them, in order to provide a quick feedback to enable a rapid iterative workflow.

3 INTERACTIVE MACHINE LEARNING

In the Classical Machine Learning model classifiers are automatically created by the system. This model can be slow, non-interactive and requires a lot of technical knowledge to produce the desirable results [11]. Interactive Machine Learning was developed to make the process iterative and interactive allowing users to edit the system until their desired result was met. It also opens up the potential of non-programmers being able to create, control and customise machine learning applications. Interactive Machine Learning allows a user to iteratively build and refine a machine learning model to guide the system to produce the desired behavior [22]. This process can include adding or editing the training data [11] [23] and adjusting the classification of data [22] [24] through rapid cycles of training, evaluation of performance and editing the model to improve performance. IML can make the process faster, more controlled and more accessible to non-expert users.

4 INTERACTML

The InteractML tool is aimed at artists, dance practitioners as well as game developers to facilitate the quick and easy implementation of movement interaction designs into interactive applications. It is based on a similar model to Fiebrink's Wekinator [25] whereby the user performs examples of their movement design, classifies the movement data with an output value which can be used to trigger events via IML, such as controlling sound events. InteractML is a plug-in for Unity 3D game engine software (https://unity.com/), Unity allows creators to extract data from movement sensor technology, such as game controllers or motion-capture suites for use within a 3D environment. The toolkit is designed so that artists and dancers who are not developers are able to hold creative control over their movement interaction designs up until the implementation stage.

5 DISCUSSION

An important feature of embodied ideation approaches for designing movement interaction is incorporating 'embodied sketching' through the full iterative design process. However, there is a lack of tools that enable quick cycles between embodied exploration and system response. Here we offer a toolkit and method that allows for a quick and rapid cycle from design to feedback, allowing for a continuity between the ideation and implementation phase, allowing creators to explore this pairing without the boundary of a lengthy implementation process.

Such a rapid cycle throws up questions as to how creators will approach movement interaction design in this manner: What will be the effect of enactment and embodied exploration coupled with immediate system feedback? Will this immediacy promote or inspire new explorative movement practices? Will it change how creators approach interactivity with movement-based systems in their creative work?

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