# A Sensor is not a Sensor: Diffracting the Preservation of Sonic Microinteraction with the SiFiBand

Hugh Alexander von Arnim
RITMO, Department of Musicology
University of Oslo, Norway
hughav@uio.no

Çağrı Erdem*
Department of Informatics
University of Oslo, Norway
cagrie@uio.no

Ulysse Côté-Allard*
Department of Technology Systems
University of Oslo, Norway
ulysseca@uio.no

Alexander Refsum Jensenius
RITMO, Department of Musicology
University of Oslo, Norway
alexanje@uio.no

## Abstract

In this paper, we document our exploratory work to preserve the interactive music system *Stillness Under Tension*—developed to explore inverse sonic microinteraction—by porting it from the original and discontinued Myo sensor armband to SiFiBand, a new prototype armband with motion (IMU) and muscle (EMG) sensors. We approach this by merging the Multilevel Dynamic Preservation model with a "diffraction-in-action" method grounded in a theoretical entanglement perspective. Rather than focusing on the Myo version's artefactual remains, we explore the difference in data representations offered by the two devices as our point of departure. The paper describes the sensor devices, evaluating their data representations given their technical specifications, and describing how these differences propagate throughout our attempt to preserve the system, enacting necessary changes. We discuss the implications of merging these methods in view of the long-term preservation of interactive music systems. Our version 2.0 of *Stillness Under Tension* finds itself experientially in a position between familiarity and newness.

## CCS Concepts

• **Applied computing** → **Sound and music computing**; • **Human-centered computing** → **Sound-based input / output**.

## Keywords

Preservation, Diffraction, Sensor, EMG, IMU, Interactive Music Systems, Microinteraction, Entanglement

**ACM Reference Format:**
Hugh Alexander von Arnim, Çağrı Erdem, Ulysse Côté-Allard, and Alexander Refsum Jensenius. 2025. A Sensor is not a Sensor: Diffracting the Preservation of Sonic Microinteraction with the SiFiBand. In *Proceedings of 20th International Audio Mostly Conference (AM '25)*. ACM, New York, NY, USA, 8 pages. https://doi.org/XXXXXXX.XXXXXXX

*Both authors contributed equally to this research.


*AM '25, Coimbra, Portugal*

ACM ISBN 978-1-4503-XXXX-X/2018/06
https://doi.org/XXXXXXX.XXXXXXX

## 1 Introduction

*Stillness Under Tension* is an interactive performance piece developed to explore inverse sonic microinteraction [17]. The work involves performers controlling the amplitude of eight oscillators through tensing the muscles in their forearms while keeping the arm as still as possible, lest the oscillators be silenced. It was specifically composed for the Myo armband, a wearable sensor array consisting of an 8-channel electromyography sensor (EMG) and an inertial measurement unit (IMU) (Figure 1). The piece was part of a "wave" of artistic exploration of this particular now-legacy device [2, 6, 7, 15, 23]. One reason for the creative research interest in the Myo was the opportunity to work with muscle signals captured using EMG, a notoriously challenging—and therefore interesting—signal type to work with [24]. *Stillness Under Tension* was premiered in 2017 and has been performed numerous times with varying numbers of performers (1–6). The Myo has been discontinued, and remaining devices have gradually become nonfunctional. Yet, there is a repertoire of pieces developed for and with the device, including musical instruments, interactive music systems, and multimedia performance systems that are no longer usable.

This paper reflects on the importance of a legacy sensor device that has influenced the music technology community. We also explore how it is possible to preserve a piece—in our case *Stillness Under Tension*—by porting it to a new prototype sensor interface with similar characteristics. The SiFiBand is developed by the company

**Figure 1: Two similar yet different sensor armbands: The legacy Myo armband (left) and the SiFiBand prototype (right).**

SiFi Labs[1] and is a prototype device that functionally resembles the Myo (Figure 1) and also has an 8-channel EMG and an inertial measurement unit (IMU). Due to recent advances, it has a higher sampling rate and also contains several additional biosensors, including electrocardiography (ECG), measuring the heart's electrical activity, photoplethysmography (PPG), using light to track blood flow and heart rate, and electrodermal activity (EDA) monitored through skin conductance, and skin temperature.

Because of Myo's discontinuation, the preservation of *Stillness Under Tension* requires not only a technical transition but also a reflection on the qualitative shifts introduced by the SiFiBand. This raises several questions: How can we carry out this transition to preserve *Stillness Under Tension* in a way that acknowledges how these shifts propagate throughout the wider system, influencing the experience of interacting with the system? Moreover, how can we reconsider preservation models to focus on the differences between the sensor's data representations of physical processes rather than the artefactual remains of the system?

## 2 Background and Related Work

### 2.1 Preserving Interactive Music Systems

Significant effort is dedicated to maintaining the functionality of interactive music systems, particularly for early, pioneering work, such as David Wessel's *Slabs* [10]. However, maintaining these systems presents an additional challenge. Beyond preserving technical functionality, it is equally important to retain the experiential qualities of playing, interacting, and performing with them [4, 5].

Within the New Interface for Musical Expression (NIME) community, there is a growing interest in addressing system longevity [16, 18, 20]. While a key motivation is encouraging sustainable practices within the community [19], archival and preservation efforts form another central strand. Masu et al. identify *updating* as a primary strategy for sustaining systems [18]. For example, when the off-the-shelf controller used in AirSticks 1.0 [11] was discontinued, it was replaced with an IMU in AirSticks 2.0 [26].

Fiordelmondo et al. [9] propose adapting the Multilevel Dynamic Preservation (MDP) model [8] in the preservation of artworks. This model originated to aid in preserving time-based media art and updated artworks are viewed as iterative, with any "activation" of an artwork resulting in a Digital Preservation Object (DPO). A DPO consists of three types of items: *bits* (hardware and software), *data* (information to aid in realisation), and *experience* (artefacts which document the DPO). A key factor is that bits and data express a multiple belongingness property—they can belong to multiple DPOs—enabling the mapping of system components across multiple iterations. The authors propose five steps to "reactivate" an interactive system (and create a new DPO): Collection, Assessment, (Re)Design, Implementation, and Archiving.

While the authors demonstrate the model's utility through its application in the reactivation of an educational game for Deaf children, these five steps strongly emphasise the system's functionality. We see the opportunity to investigate the qualitative differences in interaction that arise through the required modifications and how these, in turn, reflexively drive the preservation process. In our case, the locus of preservation is the sensor. Therefore, it is worthwhile to investigate how two sensors measuring the same phenomenon derive quite different data representations and how this propagates outward into interaction with the system.

[1] https://sifilabs.com/

### 2.2 Sensor Entanglements

Widely adopted models of interactive music systems, particularly those relating to digital and electro-acoustic musical instruments, centre a chain of steps to map physical actions to resultant sounds [14]. A key step is acquiring an electrical or digital representation of the action using one or more sensors. Given this, there is a lineage in interactive music system design of considering sensors in terms of their ability to adequately measure physical quantities of the action (e.g. [3]), thus abstracting the sensor to its modalities and technical specifications when considering the system design at a higher level, divorced from its implementation.

However, data representations—even those resulting from sensors of identical specification—are not necessarily interchangeable. Entanglement as a theoretical foundation is gaining ground in various HCI subfields. From this perspective, a growing body of work approaches design with sensor data from a standpoint of "diffraction" [21]. This perspective views sensor data generation as inherently situated within a broader network of relationships, aligning with Barad in that the methods are "respectful of the entanglement of ideas and other materials [...] attuned to the entanglement of the apparatuses of production" [1, pp. 29-30]. In this sense, sensors are not merely used to acquire gestural information but are located within a network of entangled agencies and "intra-actions". For example, Naccarato and MacCallum [22] argue that an overt emphasis on the physiological process measured by a biosensor embeds ethical values into its design regarding an empirical conception of what the process *is* and what the body parts involved *can do*, influencing further mappings.

Sanches et al. [25] pose "diffraction-in-action" as a design method, with the aim of "documenting patterns of difference, and testing how different ways of becoming with the world and with sensors can produce different forms of data in general or biodata in particular" [25, p. 13]. They organise this into three design principles: 1) engagement with data is open-ended, 2) engagement with data is a slow and long-term process, and 3) space should be left for messiness and ambiguity.

We therefore see the potential to approach the creation of a new DPO for *Stillness Under Tension* from a perspective of "diffraction-in-action". Beyond documenting the *bits*, *data*, and *experience* items, we should also evaluate the sensor's data representations and how this propagates outwards across the system, resulting in a qualitatively different experience of interacting with the system.

## 3 Reactivating *Stillness Under Tension*

In the following, we outline our efforts to reactivate *Stillness Under Tension* for the SiFiBand. While we follow the broad shape of the MDP model (Collection, Assessment, (Re)Design, Implementation, and Archiving), beyond the collection step, we consider the data representations provided by each device as our point of origin.

## 3.1 Collection

*Stillness Under Tension* comprises three primary mappings. The inputs from the eight EMG channels are mapped to the amplitude of eight oscillators, forming an ascending series of partials. The frequency of the fundamental is mapped to the IMU orientation pitch. The continuous EMG input creates a rich, shimmering tone that constantly shifts in timbre. This is only the case when the user holds the arm still. As soon as motion is detected, the instrument turns silent. This is operationalised by using the Quantity of Motion (QoM) of the forearm—calcluated as the sum of the vector magnitude acceleration and angular velocity of the IMU—to control the master amplitude of the system. Based on an "inverse" mapping, it ramps to zero when motion is detected and slowly returns to its original value over 30 s when the user stands still.

The system was presented at the NIME conference in 2018 [17], focusing on its implementation for the Bela microcontroller. In addition, various sources (blogs,[2] personal websites,[3] and a book [14]) document performances. From these, we can collect *data* and *experience* items, forming the foundation for DPO-01.

The sources reveal that *Stillness Under Tension* was directly inspired by a previous interactive system targeted towards use in installations: *MicroMyo* [15]. This system was also based on mapping Myo's eight EMGs to the amplitudes of eight partials, with the fundamental frequency mapped to the IMU pitch. However, there are several key differences, the most prominent being how *MicroMyo* maps the QoM to continuous amplitude control. Digging further into the sources reveals that the inverse mapping used in *Stillness Under Tension* has its roots in the *Waving Sines* instrument [12], which inversely maps the QoM extracted from markers placed on performers' heads using an optical, marker-based motion capture system to the amplitude of sine tones. From these, we defined *data* and *experience* items for DPO-0.1 and DPO-0.2.

Regarding *bits*, *Stillness Under Tension* has been included in a GitHub repository containing the code to connect the Myo with a Bela.[4] In addition, one of the Bela systems used in previous performances was available at our institution, and the C++ code and Pure Data (PD) patch comprising the DPO-01 software *bits* were still stored on it.

## 3.2 Assessment

Instead of starting from a position of assessing issues and vulnerabilities in the previous DPOs as suggested by the MDP model, our point of departure was one of "diffraction". Namely, we were aware of the centrality of the sensing device in the preservation process, so our assessment began there. While the Myo and SiFiBand share similarities, key differences shape their data. Over several months, we familiarised ourselves with the SiFiBand's data representations, both within the context of this project and others. We also aimed to quantitatively characterise its sensor data in relation to the Myo to link these differences to qualitative differences in the new DPO. Below, we outline evaluations depicting these differences, recognising that our findings are themselves situated and entangled.

[2]https://mct-master.github.io/other/2018/09/07/opening-ceremony-stillness-under-tension.html

[3]https://charlesmartin.au/blog/2018/07/17/NIME2018

[4]https://github.com/cpmpercussion/bela-myo-example

*3.2.1 Technical differences.* Technical specifications related to data resolution for both devices are shown in Table 1. The most prominent difference between the two is the SiFiBand's much higher EMG resolution, both for the sampling rate and bit depth.

**Table 1: Sampling rates and bit depths for Myo and SiFiBand inertial measurement unit (IMU) / electromyography (EMG)**

| Specification | IMU | | EMG | |
|---|---|---|---|---|
| | Myo | SiFiBand | Myo | SiFiBand |
| Sampling rate (Hz) | 50 | 50 | 200 | 2000 |
| Bit depth (bits) | 16 | 19 | 8 | 12 |

The devices also differ in several functionalities. Both transmit data via Bluetooth Low Energy (BLE), but the Myo is most commonly used with a dedicated dongle, unlike the SiFiBand. In addition, the Myo transmits data in packets of single samples for the IMU and two samples for the EMG, while SiFiBand transmits data in packets of eight samples for all sensors. The devices also use different data formats and units. The SiFiBand provides EMG data in mV, whereas the Myo outputs unitless ADC readings. The Myo outputs acceleration data in g compared to the SiFiBand's $m/s^2$. In addition to linear acceleration, the Myo also provides rotational velocity. Both devices supply orientation quaternions.

In the following, we describe several technical metrics related to the musical actions that form the basis of the mappings for *Stillness Under Tension*. We focus on the EMG data, since this sensor has the largest gap in technical specifications between devices and is a signal type which can result in significantly differing data representations. As the system is primarily concerned with microinteraction—sensing micromotion as a driver for interaction [13]—we evaluate the noise level and latency of the EMG. We also assess the differences in the signals acquired from each channel over several actions and ranges of the EMG channels.

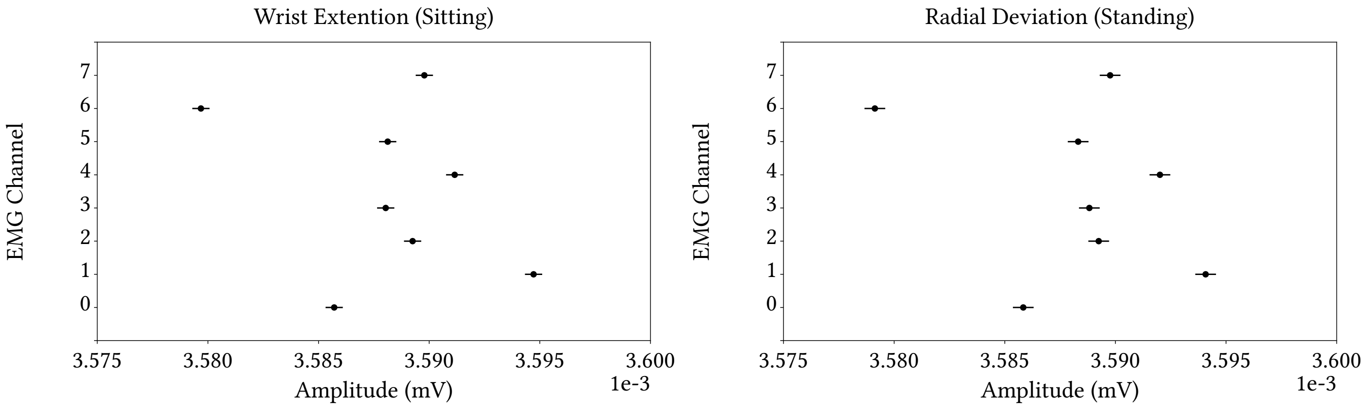
*3.2.2 Data Collection Procedure.* Data was collected using a custom Python data logger. The logger is modular in design, allowing simultaneous logging of Myo and SiFiBand devices. Across all data, a timestamp is appended to each packet upon reception. An event logger module allows the manual addition of timestamped descriptive markers. As we no longer possess a functional Myo dongle—an example of the difficulties facing the usage of a legacy product—the Myo data is streamed directly via the logging computer's BLE antenna. For this, we built our Myo logger on a backbone of dl-myo (Dongle-less Myo).[5]

We employed the Arbitrary Waveform Generator (AWG) of a BitScope Micro[6] to generate the stimuli for evaluating the EMG sensors. To handle low-level communication, we developed an additional module enabling controllable and timestamped signal generation, using ScopeThing.[7] The resolution of the Bitscope's peak-to-peak output voltage only allows gradations of 0.1 V, meaning that it cannot directly output signals that fall within EMG input

[5]https://github.com/iomz/dl-myo

[6]https://www.bitscope.com/product/BS05/

[7]https://github.com/jonathanhogg/scopething




**(a) Wrist Extension (Sitting)**

**(b) Radial Deviation (Standing)**

**Figure 2: Tukey HSD test results for SiFiBand EMG recordings. A similar pattern was seen across all actions.**

voltage ranges. A voltage divider used to reduce the signal amplitude results in the addition of noise, although this applies equally to the evaluation of both devices.

*3.2.3 EMG Noise.* We generated a sine signal of 10 Hz with a peak-to-peak amplitude of the device's input voltage range and passed this through the EMG housed in the central unit of both devices for five minutes. To account for slight fluctuations in signal amplitude, we normalised each signal based on its envelope obtained through the Hilbert transform. In analysis, we computationally generated a reference sine with identical frequency and amplitude and obtained the phase through its cross-correlation with the logged signal. We operationalised the difference between the logged signal and the reference signal as noise and calculated the signal-to-noise ratio (SNR) as the $log_{10}$ relationship between the variance of the logged signal and the noise. The results show that the SiFiBand outperformed the Myo, achieving an SNR 5.05 dB higher while also offering a five-fold increase in bandwidth and a 10× sampling frequency.

*3.2.4 EMG Channel Differences.* For the SiFiBand, we replicated the 12 actions and analysis reported as Experiment 2 in [15] (finger extension/flexion, wrist extension/flexion, radial/ulnar deviation in both sitting and standing positions) with the exception that we employed a single participant repeating each action six times for 3 s. The results of a Repeated Measures ANOVA ($p < 0.005$) for the means of the repetitions show statistically significant differences between channels for all actions. Running a pairwise post hoc Tukey HSD showed a repeating pattern across all actions of significant differences between the means of the EMG channels for most pairwise comparisons, except a cluster of emg3 (adjacent to the central housing unit), emg5 (on the anterior forearm), and emg2 (adjacent to emg5) (Figure 2). For several actions (primarily flexions and extensions), this extended to emg7 (adjacent to the main housing unit on the opposite side of emg3). This contrasts with the findings for the Myo reported in [15], for which there were no significant differences between sensors, except for those located on the anterior forearm for flexions and extensions.

*3.2.5 EMG Ranges.* Figure 3 shows aggregated distributions for each EMG channel across all repetitions. The signal range obtained by each EMG channel heavily depends upon the action performed and body position, in contrast to the Myo [12]. Moreover, signals generated by muscle activation occupy a small part of the SiFiBand's input voltage range.

*3.2.6 EMG Latency.* We generated 500 identical sine signals, each lasting 1 s, using the same parameters as those used in the noise evaluation. These signals were passed through the EMG housed in each device's central unit, and the initialisation timestamp of the AWG was logged for each. Similarly to the noise evaluation, we normalised each logged signal based on its envelope. As a measure of latency, we computationally generated a reference signal of a single period (0.1 s at 10 Hz) and calculated the cross-correlation for each of the 500 examples. Summary statistics are shown in Table 2.

**Table 2: EMG Latency**

| Device | Mean (s) | Median (s) | SD (s) | IQR (s) |
|---|---|---|---|---|
| Myo | 0.026 | 0.035 | 0.0977 | 0.01 |
| SifiBand | 0.009 | 0.0005 | 0.0307 | 0.016 |

## 3.3 (Re)Design and Implementation

Although the MDP model posits (re)design and implementation as separate steps, we combine these as we find them tightly coupled. In the following, we recount the (re)design and implementation process narratively, centring the influence of the data representations on our decisions.

The first step was reactivating the previous DPO to get a feel for the interaction (Figure 4a). We decided to run the software on a PC instead of the original Bela to compare implementations more easily. The inverse mapping was not present in the PD patch that we obtained from the Bela and had to be reimplemented. Although this mapping is documented at the high level in the *data* items, no information is provided regarding the QoM threshold. We, therefore, trialed various values until we settled on one (value:

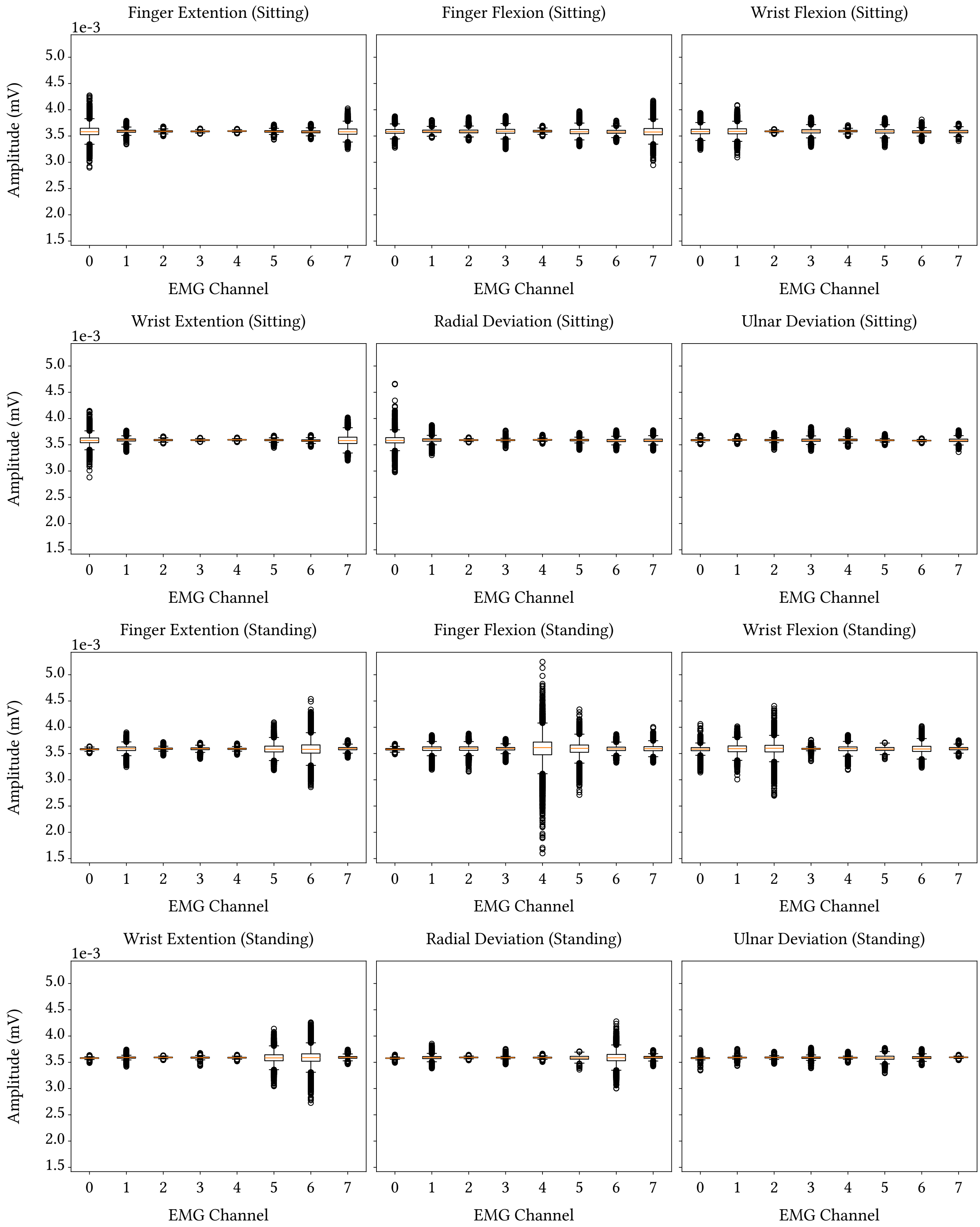



**Figure 3: Distributions of SiFiBand EMG recordings for each action. Each action shows the aggregate of all repetitions.**

**(a) Wrist and finger extension with the Myo.**

**(b) Wrist extension and finger flexion with the SiFiBand.**

**Figure 4: Exploring *Stillness Under Tension* with the Myo and the SiFiBand.**

10) we felt preserved the balance between allowing micromotion and inhibiting macromotion.[8]

Our first attempt to (re)design for the SiFiBand consisted of simply replacing the Myo input with the SiFiBand input (Figure 4b). However, this required several additional pre-processing steps. First, we converted the SiFiBand's data into units that match the Myo. As the SiFiBand does not provide angular velocity, we derived this from the orientation quaternions provided. The unitless Myo EMG data inhibits direct conversion. To begin, we scaled the entire 0.006 mV range to match the $0 - 1$ amplitude range for the oscillators. This version did not feel satisfactory, with the shimmering effect of the Myo version lost due to the low dynamic range of the sensed signal within the SiFiBand's EMG input range. Moreover, this version did not seemingly react to muscle activation, as the scaled amplitude values within the range of the acquired signals were so small that there was no perceptual difference. Additionally, the delivery of IMU data in packets of eight, as opposed to the Myo's single samples, made the pitch control feel more discrete than continuous.

We made several adjustments to the new system to make the SiFiBand version more similar to the original. First, taking the means of the 25$^{th}$ and 75$^{th}$ percentile values across all actions for each EMG channel from the data described in section 3.2.4 as a lower and upper bound, we applied a separate scaling for each EMG oscillator mapping. This immediately made the system feel much more responsive, which we ascribe to the lower latency and higher sampling rate. However, as a corollary of what we assume is the high bit depth and low noise floor—meaning less fluctuation in oscillator frequency without muscle activation and a higher gradation of possible frequency values—the SiFiBand version feels perceptually more like a single, drone sound with fluctuation in timbre, as opposed to the Myo version's more distinctly separable tones. This effect became more pronounced at lower fundamental frequencies, so we reduced the IMU pitch mapping range. Even if the overall "feeling" is preserved, this leads to quite a different experience when interacting with the system, wherein discerning the sonic consequences of individual actions becomes a lot more complicated.

To remove additional processing steps, we experimented with replacing the rotational velocity extracted from the quaternions in the QoM by taking the vector magnitude of the differential of the x, y, and z quaternions. We found that this was an adequate replacement; however, the characteristic reception of IMU samples in eight packets persisted. This leads to a noticeable latency in the inverse mapping compared to the Myo version, which we embraced as part of the interaction with the new system.

## 3.4 Archiving

Archiving takes the form of presenting the work done to reactivate the system in this current paper as *experience* and *data* items, along with the creation of an open repository [9] containing the system's *bits* and *data*: all code and documentation for the current DPO as well as code and documentation for the data logger and quantitative evaluations.

# 4 Discussion

When considering how best to preserve *Stillness Under Tension*, the SiFiBand seems an obvious choice at first glance, possessing the

[8]A video demo of both versions can be found here: https://osf.io/zqcfv/?view_only=87ab6856c24d493890a1da4a6304b272

[9]GitHub: https://github.com/Hughav92/AM25-A-Sensor-is-not-a-Sensor
Zenodo: https://doi.org/10.5281/zenodo.15462854

same sensors as the Myo in a similar form. Moreover, with the PD *bit* from the previous DPO, it did not take much to bring the system to functionality. However, even given the adjustments made in the redesign, the experience of interacting with the SiFiBand iteration does not align directly with that of its predecessor.

The previous DPO was explicitly designed for the Myo. Therefore, choices made throughout its development, from mappings to sound synthesis, are tightly coupled with data representations offered by the device. This was actualised in several key takeaways from applying our method to adapt it for the SiFiBand. Our explorations demonstrated that sensors are not directly interchangeable; differences in qualities such as sampling rate, bit depth, and packetisation led to notable shifts in perceptual and interactional qualities with the system. These quantitative differences propagate into qualitative differences.

While the higher resolution and lower latency of the SiFiBand suggest that *Stillness Under Tension* should be easily transferable, these differences altered both the interaction and sonic characteristics of the system. As such, preserving a system built upon a foundation of hardware with a limited lifespan can necessitate a redesign to maintain the experiential aspects seen as most important by those performing the preservation. The *experience* items assume a pronounced position of importance. Obscuring the sensor's entanglements—that is, how it derives its data representations of the measured processes and how the representations propagate throughout the system—can obscure the qualitatively different experiences of interacting with the system. High-level system overviews and models, which abstract sensor interfaces and their data representations, risk obscuring these differences. This has significant implications for the long-term preservation of interactive music systems, and we, therefore, argue for considering a sensor's entanglements as a supplement to existing preservation models.

As noted by Morrison and McPherson [21], although entanglement provides a strong and valuable theoretical base for HCI work, transferring theoretical assertions into applicable methods remains challenging. We have demonstrated that merging a diffractive method with the MDP model—in which the focus is placed on the new items introduced to the system with an understanding of the nature of the items being replaced—can provide a step towards actualising theoretical underpinnings in the method.

## 5 Conclusion

In this paper, we explored the utility of preserving interactive music systems not only in terms of their functionality but also in terms of the entanglements of their separate components within the whole. We considered this in terms of the system's sensors, the data representations they provided, and how they propagated throughout the rest of the system. Approaching a model for preservation from an origin point of "diffraction-in-action" leads to a shift in interactions with the system, preserving the "feel" even if many of the system's *bits* were not preserved. With this, we have also shown that the SiFiBand is suitable for use in interactive systems working with microinteraction, albeit not directly comparable to the Myo.

The experiential differences reported in this paper are based on qualitative evaluation by the authors, including one of the original system's designers and performers. Verifying if this holds at a larger scale through more systematic user studies presents a direct line of future work. Moreover, our present approach represents exploratory steps toward integrating "diffraction-in-action" into preservation models. Developing this into a more systematic framework offers a broader opportunity for future work.

## Acknowledgments

This work was partially supported by the Research Council of Norway through its Centres of Excellence scheme, project number 262762. The 3rd author is involved in developing the SiFiBand at SiFi Labs. We thank Stefano Fasciani for providing and supporting the use of BitScope Micro.

## References

[1] Karen Barad. 2007. *Meeting the universe halfway: quantum physics and the entanglement of matter and meaning.* Duke University Press, Durham London.

[2] Christopher Benson, Bill Manaris, Seth Stoudenmier, and Timothy Ward. 2016. SoundMorpheus: a myoelectric-sensor based interface for sound spatialization and shaping. In *Proceedings of the international conference on new interfaces for musical expression.* Queensland Conservatorium Griffith University, Brisbane, Australia, 332–337. doi:10.5281/zenodo.1175982

[3] Bert Bongers. 2000. Physical interfaces in the electronic arts. Interaction theory and interfacing techniques for real-time performance. *Trends in Gestural Control of Music* (Jan. 2000), 41–70.

[4] Federica Bressan and Sergio Canazza. 2014. The challenge of preserving interactive sound art: a multi-level approach. *International Journal of Arts and Technology* 7, 4 (Jan. 2014), 294–315. doi:10.1504/IJART.2014.066451

[5] Federica Bressan, Sergio Canazza, Antonio Rodà, and Nicola Orio. 2009. Preserving today for tomorrow: A case study of an archive of interactive music installations. In *Workshop on exploring musical information spaces (WEMIS) in conjunction with ECDL 2009.* Corfu, Greece, 24–29.

[6] Balandino Di Donato, James Dooley, Jason Hockman, Simon Hall, and Jamie Bullock. 2017. MyoSpat: A hand-gesture controlled system for sound and light projections manipulation. In *Proceedings of the 43rd International Computer Music Conference*, Margaret Schedel (Ed.). Shanghai Conservatory of Music No. 20 FenYang Road, 200031, Shanghai, China, Shanghai, China, 335–340. https://quod.lib.umich.edu/i/icmc

[7] Sarah Fdili Alaoui. 2019. Making an Interactive Dance Piece: Tensions in Integrating Technology in Art. In *Proceedings of the 2019 on Designing Interactive Systems Conference.* ACM, San Diego CA USA, 1195–1208. doi:10.1145/3322276.3322289

[8] Alessandro Fiordelmondo, Alessandro Russo, Mattia Pizzato, Luca Zecchinato, and Sergio Canazza. 2023. A multilevel dynamic model for documenting, reactivating and preserving interactive multimedia art. *Frontiers in Signal Processing* 3 (June 2023). doi:10.3389/frsip.2023.1183294

[9] Alessandro Fiordelmondo, Giada Zuccolo, Sergio Canazza, and Raul Masu. 2024. Longevity in NIME research: a case study using time-based media art preservation models. In *Proceedings of the international conference on new interfaces for musical expression*, S M Astrid Bin and Courtney N. Reed (Eds.). Utrecht, Netherlands, 292–301. doi:10.5281/zenodo.13904858 tex.articleno: 43 tex.track: Papers.

[10] Adrian Freed. 2016. David Wessel's Slabs: a case study in Preventative Digital Musical Instrument Conservation. In *Proceedings of the 13th Sound Music Computing Conference (SMC 2016).* Zentrum für Mikrotonale Musik und Multimediale Komposition (ZM4), Hochschule für Musik und Theater, Hamburg, Germany, 151–155.

[11] Alon Ilsar, Mark Havryliv, and Andrew Johnston. 2014. Evaluating the performance of a new gestural instrument within an ensemble. In *Proceedings of the international conference on new interfaces for musical expression.* Goldsmiths, University of London, London, United Kingdom, 339–342. doi:10.5281/zenodo.1178812

[12] Alexander Refsum Jensenius. 2015. Microinteraction in music/dance performance. In *Proceedings of the international conference on new interfaces for musical expression*, Edgar Berdahl and Jesse Allison (Eds.). Louisiana State University, Baton Rouge, Louisiana, USA, 16–19. doi:10.5281/zenodo.1179100

[13] Alexander Refsum Jensenius. 2017. *Sonic Microinteraction in "the Air".* Routledge, New York, 429–437. doi:10.4324/9781315621364

[14] Alexander Refsum Jensenius. 2022. *Sound actions: conceptualizing musical instruments.* The MIT Press, Cambridge.

[15] Alexander Refsum Jensenius, Victor Gonzalez Sanchez, Agata Zelechowska, and Kari Anne Vadstensvik Bjerkestrand. 2017. Exploring the Myo controller for sonic microinteraction. In *Proceedings of the international conference on new interfaces for musical expression.* Aalborg University Copenhagen, Copenhagen, Denmark, 442–445. doi:10.5281/zenodo.1176308

[16] Adnan Marquez-Borbon and Juan Pablo Martinez-Avila. 2018. The problem of DMI adoption and longevity: Envisioning a NIME performance pedagogy. In *Proceedings of the international conference on new interfaces for musical expression*, Douglas Bowman Luke Dahl, Thomas Martin (Ed.). Virginia Tech, Blacksburg, Virginia, USA, 190–195. doi:10.5281/zenodo.1302541

[17] Charles Patrick Martin, Alexander Refsum Jensenius, and Jim Torresen. 2018. Composing an ensemble standstill work for myo and bela. In *Proceedings of the international conference on new interfaces for musical expression*, Douglas Bowman Luke Dahl, Thomas Martin (Ed.). Virginia Tech, Blacksburg, Virginia, USA, 196–197. doi:10.5281/zenodo.1302543

[18] Raul Masu, Fabio Morreale, and Alexander Refsum Jensenius. 2023. The O in NIME: Reflecting on the importance of reusing and repurposing old musical instruments. In *Proceedings of the International Conference on New Interfaces for Musical Expression*. Zenodo, Mexico City, Mexico, 106–115. doi:10.5281/zenodo.11189120

[19] Nicolo Merendino, Mela Bettega, Adam Pultz Melbye, John D. Sullivan, Antonio Rodà, and Raul Masu. 2024. Sustainable digital fabrication in NIME: Nine sustainability strategies for DMI production. In *Proceedings of the international conference on new interfaces for musical expression*, S M Astrid Bin and Courtney N. Reed (Eds.). Utrecht, Netherlands, 266–274. doi:10.5281/zenodo.13904850

[20] Fabio Morreale and Andrew McPherson. 2017. Design for longevity: Ongoing use of instruments from NIME 2010-14. In *Proceedings of the international conference on new interfaces for musical expression*. Aalborg University Copenhagen, Copenhagen, Denmark, 192–197. doi:10.5281/zenodo.1176218

[21] Landon Morrison and Andrew McPherson. 2024. Entangling entanglement: a diffractive dialogue on HCI and musical interactions. In *Proceedings of the 2024 CHI conference on human factors in computing systems (Chi '24)*. Association for Computing Machinery, New York, NY, USA. doi:10.1145/3613904.3642171

[22] Teoma J. Naccarato and John MacCallum. 2017. Critical Appropriations of Biosensors in Artistic Practice. In *Proceedings of the 4th International Conference on Movement Computing*. ACM, London United Kingdom, 1–7. doi:10.1145/3077981.3078053

[23] Kristian Nymoen, Mari Romarheim Haugen, and Alexander Refsum Jensenius. 2015. MuMYO — evaluating and exploring the MYO armband for musical interaction. In *Proceedings of the international conference on new interfaces for musical expression*, Edgar Berdahl and Jesse Allison (Eds.). Louisiana State University, Baton Rouge, Louisiana, USA, 215–218. doi:10.5281/zenodo.1179150

[24] Courtney N. Reed, Landon Morrison, Andrew P. McPherson, David Fierro, and Atau Tanaka. 2024. Sonic entanglements with electromyography: Between bodies, signals, and representations. In *Proceedings of the 2024 ACM designing interactive systems conference (Dis '24)*. Association for Computing Machinery, New York, NY, USA, 2691–2707. doi:10.1145/3643834.3661572

[25] Pedro Sanches, Noura Howell, Vasiliki Tsaknaki, Tom Jenkins, and Karey Helms. 2022. Diffraction-in-action: Designerly explorations of agential realism through lived data. In *Proceedings of the 2022 CHI conference on human factors in computing systems (Chi '22)*. Association for Computing Machinery, New York, NY, USA. doi:10.1145/3491102.3502029

[26] Sam Trolland, Alon Ilsar, Ciaran Frame, Jon McCormack, and Elliott Wilson. 2022. AirSticks 2.0: Instrument design for expressive gestural interaction. In *Proceedings of the international conference on new interfaces for musical expression*. The University of Auckland, New Zealand. doi:10.21428/92fbeb44.c400bdc2 tex.articleno: 51.