Creative Practice as an Evaluation Method: A Case Study with a Movement-based Musical Instrument

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ABSTRACT

The creative process with technology requires experimentation, exploring affordances and limitations, and evaluation of one's process of different learning stages. Movement-based digital musical instruments (MDMIs) offer many opportunities to study performers' creative processes since performers can artistically explore both the familiar and unfamiliar interactions with the instruments. In this research, we integrate the creative process as a performance-based, qualitative evaluation method into studying performers' interactions. While these processes are often non-linear and iterative, we observe how creativity, through sonic and movement interaction, impacts participants' learning processes. We study these processes with participants from music and/or dance dance backgrounds and report on their experiences.

Author Keywords

creative practice, aesthetics-based evaluation, movement-based musical instruments, embodied interaction

CCS Concepts

•**Human-centered computing** → **User studies;** •**Applied computing** → *Performing arts; Sound and music computing;*

1. INTRODUCTION

Digital musical instruments (DMIs) extend the creative space of musical performance where the interface is more commonly evaluated based on technical specifications and design considerations [48, 34] or based on performance from the audience's perspectives [39]. O'Modrain emphasizes the different perspectives (audience's, performer's, and designer's) involved in evaluating these interactions. However, the evaluation methods and performance practices remain separate or the studies that focus on "performability" report from a subjective and retrospective account of a single performer. Similarly, the creative practice with digital interfaces is much less frequently studied as an evaluation approach within these user studies [9, 18]. Bossen et al. emphasize the importance of studying creative practice and constructing creative artifacts [5]. He states that regardless of participant background, a performative task supports developing personalized movement and sound vocabulary and *organizing expressive ideas.* This approach can highlight the aesthetic experience of DMIs, supporting a longitudinal performance practice or sustained use [41].

In this paper, we study evaluating digital musical instruments beyond their technical qualities by integrating creative practice into user evaluation. To encourage creative practice both in music and movement expressivity, we ask participants to develop a compositional practice in these two domains using Bodyharp. Bodyharp is a movement-based musical instrument (MDMI) that integrates performers' bodies directly into the physical interface, extending the performers' bodies beyond the instrument [11, 10]. This dual interaction allows us to explore creative practices in music and dance through their shared and distinct qualities. Our study asked participants to develop creative artifacts as research outcomes, encouraging the participants to focus on developing their creative practices. We collected participants' experiences through semi-structured interviews with twenty artists whose backgrounds are in music, movement, or both.

Our contribution is threefold. Through systematically integrating creative practice into user evaluation, we better understand the barriers and supporting factors in developing a potentially ongoing instrumental practice with movement-based musical instruments. Second, we offer an evaluation approach highlighting the performer's bodily, felt experiences through closely linked music and movement expressions and we incorporate embodied, soma-based evaluation methods [27]. Third, we provide criteria to aesthetically and more holistically evaluate new musical instruments that would support their sustained use beyond user studies.

2. RELATED WORK

2.1 Movement-based Interaction

Movement-based interaction introduces an approach that focuses more on the interaction of the moving body as an integral part and less on the interface [30, 33]. Various recent design and research frameworks [32] on movement-based interaction are dedicated to *the role of the body and bodily movement.* However, as Moen emphasizes, "we still lack the tools, knowledge, and vocabulary to discuss the movement and the experience of movement" [37]. To extend her argument, this section emphasizes that we need not only the tools to experience movement but also the interaction modalities to reveal the motivation and drive to move in

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response to music that is not often visible to the observer or even to the performer.

Gesture-based and movement interactions have been an interest to NIME research since the design of new instruments [23, 8, 47]. However, body and body movement were more strongly integrated into instrument design with wearable instruments. These wearable technologies were initially developed as hand or glove controllers by musicians, specifically to create customized interfaces such as Waisfisz's "The Hands" [44], Sonami's "Lady's Gloves" [42], and Tanaka's Biomuse [43]. Following Tanaka's work, Donnarumma also adopts a performance-based approach where he focuses on describing gestures through muscle sensing [15].

Similarly, in NIME research, dance and music interaction closely influenced each other as much as interface design. These interfaces, or installations, tend to generate sound output based on the dance or body movements as main sound-producing gestures. From earlier examples of dance-music interactions [24, 2] to more recent developments [19, 12, 36, 45, 38, 1], researchers explored musical interactions through sensory technologies. Mainsbridge focuses on body movements as a non-tactile interaction mechanism to control sound parameters through improvisation [36].

2.2 Creative Evaluation

Creative practice supports the making process beyond creating a new artifact, leading to conceiving and realizing ideas in numerous forms [9]. These artifacts can vary from designs to music composition and performances. Candy and Edmonds characterize this creative practice "not only by a focus on creating something new but also by the way that the making process itself leads to a transformation in the ideas" that contributes back to the creative artifacts [17, 18].

In music and movement research, as creative artifacts, new musical instruments lead to new creative practices such as music composition, performance, and choreography. Because of the artistic practice behind these research outcomes, research assessments that involve qualitative, exploratory, and aesthetics-based evaluations are needed [26]. Such evaluation offers distinct advantages to studying creative artifacts and the insights and reflections from their creation process. It provides "the possibility of taking account of context" such as the inclusion of participants in the creative practice, the ability to describe as it is perceived from different observer perspectives such as combining first and third-person approaches, and "strong process orientation" such as learning and creation processes [22].

The outcomes of creative practice can serve as assessment tools. Ramsay and Rockwell state that creative artifacts are "tools that show us something in a new light" [40]. Both from first and third-person observations, body movement during music-making reveals inner intentions of music-related gestures and expressions [13, 14, 31, 21, 46]. In NIME research, Jack et al. discuss how Digital Musical Instruments (DMIs) can be considered as research products [28]. However, they exclude creative artifacts such as musical pieces or gestural vocabularies from the category of research products, although they consider performance as research outcome.

Mainsbridge conducts performance-led research through performative inquiry and performance ethnography to capture the first-person moment and draw reflection on the practice [36]. Through reflection-in-action in live performance, she studies specific design values of her gesture-based instrument: values of agency, autonomy, empathy, and transparency [35]. Hayes encourages "creative musical participation" to understand technology's effects on music-making [25]. Donnarumma highlights the importance of performance *"as a site where to inhabit hybrid forms of human-machine embodiment"* [16], to understand body- technology relationships based on Berliner's approach that evaluates instrumental practice by adapting "successful performance" as criteria [4]. These researchers emphasize the role of performance in new instrumental design. However, we still lack methodologies that encourage creative practice as an evaluation method for new musical interfaces.

Figure 1: Bodyharp, as a wearable string instrument, allows performers to play with larger-scale gestures (such as arm movements) and small, nuanced gestures for finer sound control. The instrument is flexible in shape and size, extending the performers' range of movement and space.

3. FRAMING THE CURRENT WORK

3.1 Previous Work

This study focuses on how integrating creative practice contributes to evaluating new digital musical instruments, specifically wearable, body- and movement-based instruments. Bodyharp (see Figure 1) was previously studied to understand how performers engaged with *Body* and *Space* use in their interaction [10]. These qualities were quantitatively analyzed based on Laban Movement Analysis [29, 20]. The results of the previous study inspired this study to investigate the creative practice in evaluating the music-movement interaction with the instrument. In this study, we focus on how creative practice affects participants' learning and practicing processes when integrated into the user study. The details and evaluation of playing techniques and sound mapping are beyond the scope of this research but can be accessed in [10]. We report how creativity can be utilized to evaluate MDMIs beyond technical, practical, and quantitative measures. We also investigated performance possibilities, suggested by participants and later realized in real-life scenarios.

3.2 Playing Bodyharp

Bodyharp consists of an instrument body and wearable parts including a hand controller and an attachment to the performer's arm, connecting the strings to the arm (see Figure 1). The instrument is played by plucking the string or moving the attached arm to initiate sound production [11]. The performer later interacts with tactile and motion sensors in the hand controller to control sound effects. These controls include changing the chord progressions (with push buttons), filter quality factor (with circular pressure sensor–FSR), gain and note duration (with sliders), and filter drive factor (with square FSR). The sound mapping was implemented in ChucK audio programming language [1] to receive and process the sensor data, control string physical models, and record audio output of performances. The performers can further interact with the string interface by plucking, stretching, moving their arms, or isolating individual strings. Expressive interactions can provide new affordance although the sound excitation mechanism remains the same [10].

4. METHODOLOGY

The experiment focused on the process of learning through gestural/movement exploration, practicing nuanced control, and developing creative artifacts through sound-movement interaction. We investigated their learning process and compared this process to their creative practice with the instrument. The creative practice included creating musical and movement compositions. First, participants learned the instruments through the linked music-movement interactions. Later, the two domains were isolated to unpack how participants reflected on their coupled and decoupled music and movement interactions.

4.1 Participants

The study recruited twenty participants with artistic backgrounds in sound, movement, or both via email. All participants provided informed oral consent before the study. Participants with backgrounds in sound (nineteen of the 20 participants) engaged in music performance, composition, instrument design, and audiovisual performance. Participants with backgrounds in movement (thirteen of the 20 participants) performed as dancers or worked as choreographers, performer artists, or contact improvisers. Most performers had artistic practice in other creative fields in addition to their music or movement backgrounds such as theater, poetry, photography, and playwriting. Twelve participants had experience in both music and movement. Their levels of experience varied from professional artists to self-taught, self-exploratory backgrounds. We reported participants' experiences according to their self-reports in Table 1. Although P10 reported their primary artistic background was in music, they chose not to disclose their age and experience in years. Only P7 did not report any information about their artistic background. The overall participant group showed a diverse distribution of age, gender (optional), and experience.

4.2 Study Design

The participants learned the instrument step-by-step based on different categories of gestural interaction in 2-hour individual sessions. In Step 1, they played the instrument only by larger-scale gestures (such as arm movements) whereas, in Step 2, they interacted with the instrument only through small-scale, nuanced gestures. In Step 3, they were able to combine both gestural spaces.

After practicing with the instrument through three learning sessions (Steps 1-3), the participants created a short musical statement in Step 4. This prompt only directed the participants to create a piece based on their explorations from the earlier stages within a short period of time, limited to approximately five minutes. However, their interaction was not timed or interrupted by the researchers. We did not pose any other limitations. Until this stage, the participants explored different possibilities with the instrument, understanding its affordance and limitation and extending these inherent interactions. They were later asked to focus on creating a cohesive composition that allowed them to reflect on their learning and practicing processes. After this step, the participants created short movement compositions/choreographies without the musical instrument in Step 5 while listening to their musical composition from the previous step. This prompt was asked to allow participants to express their musical composition using body movements beyond the interface's limitations and reflect on the sound-movement relationships.

Their creative interactions in these steps are video and audio recorded. The outcomes of the study prompts were stored for further analysis in video and audio formats. After the creative practice, in a semi-structured interview, the participants were asked to reflect on their experience during the performance practice and to brainstorm on new uses of the instrument for performance scenarios in the wild. Along with the participants, the recordings of their creative artifacts, specifically the video recordings, were returned to discuss specific moments or patterns of interaction.

4.3 Analysis

The participants' reflections were recorded through written questionnaires and audio recordings of the interview discussions. Their responses were transcribed using Otter.ai [2] for thematic analysis to identify common and unique themes among different participants, similar to Braun and Clarke's reflexive approach [6, 7]. In addition to reported experiences, participants' process of making some artistic choices was documented through researcher observations, discussions with participants, and reflections on both sound- and movement-based creative artifacts. Completion of the musical and movement statements, attentive listening of the

[1] https://chuck.cs.princeton.edu

[2] https://otter.ai

Table 1: Participant Demographics of the First Case Study

P	Age	Music	Movement	Dominant	P	Age	Music	Movement	Dominant
1	35-40	1	35	Movement	11	45-50	30	30	Movement
2	50-55	2	15	Movement	12	30-35	10	11	Music-Movement
3	25-30	10	5	Music	13	20-25	14	0	Music
4	25-30	5	16	Movement	14	20-25	22	12	Music-Movement
5	45-50	41	6	Music	15	25-30	25	1	Music
6	30-35	27	0	Movement	16	20-25	15	3	Music-Movement
7	70-75	-	-	-	17	35-40	30	0	Music
8	65-70	30	0	Music	18	20-25	20	3	Music
9	20-25	20	22	Music-Movement	19	20-25	18	6	Music-Movement
10	-	-	-	Music	20	35-40	26	0	Music

sound and movement, and other factors like repeatability and originality were taken into account in the analysis. Codes and themes were extracted using NVivo 12 software[3].

5. DEVELOPING CREATIVE PRACTICE

The participants' experiences in developing a creative practice with Bodyharp were supported in three aesthetically-driven processes from learning to creating and from reflecting to recollecting expressive ideas. Although we focus on the creative process during this study, the learning experiences remained connected to the creative process and influenced the resulting creative artifacts. The first steps of the study encouraged participants to learn how to play the instruments, existing gestures, and affordances through sonic and movement explorations. After the exploratory stages, the following steps investigated their creative process when they were asked to create a *musical statement* and *movement improvisations* based on their own compositions. We observed the evolution of how the participants developed a creative practice with a new musical instrument. Although they had never played the instrument before, their process of adapting the instrument to their artistic preferences and intentions was clearly observed across the experimental steps. In this section, we report participants' experience of developing a creative practice at three stages: (1) the learning process, (2) the creative process, and (3) the reflective process.

5.1 Learning Process

The experiment allowed the participants to individually explore the instrument's affordances by learning them at each step based on a specific gestural interaction. P10 expressed that this learning method helped with *"remembering different elements of the interaction."* This step-by-step learning helped the participants learn different gestural affordances gradually but also encouraged them to *"understand different possibilities that would be left unexplored otherwise"* within these gestural frameworks, as P11 highlighted.

Throughout the learning process, participants realized how to access different movement expressions. P2 shared how he used musical gestures and body movements: *"the majority of my mind was on how it works, [...] using the dance gesture as an interference while using musical gestures as the main control."* As highlighted by P6, the participants were able to isolate certain gestures to create the desired sound. She explained how this learning experience supported developing a creative process: *"As I was learning how to play the instrument one element at a time, I was also learning how to compose and perform with it. [...] It was very intuitive."* Their exploration, in a way, prepared the participants to think creatively and develop an evolving creative practice with the instrument.

Transitioning from exploration of movement to repetition of sounds occurred throughout the learning process. However, participants' progress varied since some preferred different gestural interactions over others. For many participants, learning how to control the sounds in a more nuanced way developed over time in these steps. For example, P12, a dancer and a musician, expressed that she initially couldn't play rhythms until she *"found the* [pressure] *sensor on the side which gave a rhythmic element to the music."* Some participants, including P2, reported challenges in controlling the dynamic range of the instrument. However, they stated that their control improved during the learning process.

5.2 Creative Process

After exploring the instrument, in Step 4, where participants composed musical statements, the participants became more focused on how their movement created specific sounds. P1, a dancer and a choreographer, reported that *"being asked to create [a musical statement] makes me much more aware of the sounds that my movements are creating."* In this step, participants returned to learned movement and sonic expressions. For example, P1 said *"I become much more aware of the sounds that I am creating, not so much of exploring but composition, having repetitions, going back to the themes I had, and repeating the same movements with my body."*

We asked the participants to articulate their compositional ideas. Most participants started this step with an idea of a compositional structure. However, even participants with experience in composition and choreography momentarily returned to exploration. P11, a dancer and a choreographer, stated that although *"sometimes I forgot that it was a performance,"* they further expressed, *"the performance kept me present."* These experiences showed that integrating creative practice into the user study supported participants' presence and focus. P4, a dancer, shared her experiences with focusing on the sound-creation process by saying *"The sound carried through my body [...], I also felt very focused [...]. There was an interesting process of attentive listening."*

Bodyharp not only facilitates sonic creativity but also simultaneously supports movement expressivity. To better understand the sound-movement correspondences, we asked the participants to improvise their composition with body movements without the instrument. When participants created movement compositions without the musical instrument, their movement response to music provided them with an opportunity to reflect on the sound-movement relationship. P4 explained "[composition and movement im-

[3]https://lumivero.com/products/nvivo/

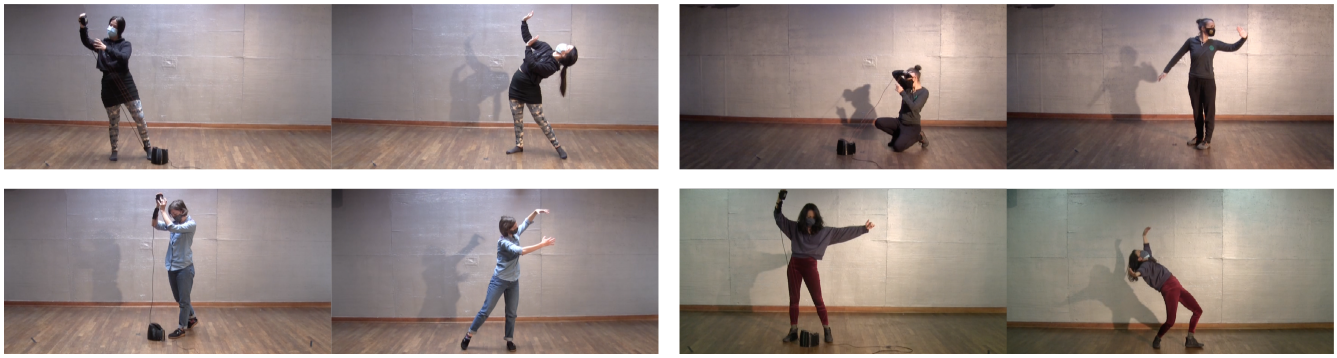

Figure 2: The moments from (a) music composition (Stage 4) and (b) movement improvisation (Stage 5) are demonstrated, respectively, for P12 (musician and dancer), P11 (dancer and choreographer), P6 (musician and composer), and P1 (dancer and choreographer).

provisation] *captured this intermediate explicit type of my movements and the sounds patterns that I create.*" Some participants realized corresponding expressions. P12 expressed that *"since I knew how I wanted to create musically, I also knew how I wanted to move to the music."* She further elaborated that she tried to *"closely reflect the music instead of doing something different."* Similarly, P4 expressed *"After I explored the sound and when it was played back, I found myself doing things in line with the* [music] *recording but not intentionally."* P11 commented on a similar experience that they were *"surprised how much* [of movement] *they remembered from the practicing with the instrument."*

The relationship between the two stages of the creative practice (music composition and movement interpretation) varied for participants with different backgrounds. Figure 2 shows moments from their (a) music composition (Stage 4) and (b) movement improvisation (Stage 5), respectively, for P12 (musician and dancer), P11 (dancer and choreographer), P6 (musician and composer), and P1 (dancer and choreographer).

5.3 Reflective Process

After creating sound and movement compositions, the participant reflected on their creative process as part of the semi-structured interview. They addressed the specific moments in their composition, drawing relationships between music and movement compositions. The following five themes emerged after analyzing the participants' reflections. As a direct result of the creative practice, these themes allowed us to extract criteria to evaluate movement-based musical instrument interaction.

5.3.1 Increased Focus on Creativity

Directing participants to develop creative artifacts with and without the instrument led them to articulate their artistic explorations in more focused, concise, and clear interactions. P1 expressed how the creative practice affected her attention:

> *"When you say, create a piece, I become much more aware of the sounds that I was creating and my composition. I was thinking not so much of the exploring, but the composition."*

Similarly, P6 reported how her awareness of body movements increased. She said *"It made me very aware of unintentional movements. It made me very aware of getting into position or moving because every movement you do is part of the piece since you are attached to it. "* She also expressed that the prompt of "create a musical statement" made her focus on something that she *"had control over."*

One of the reasons why participants stayed present and focused on their interaction was because the prompt, asking them to create a sound/movement artifact, shaped the participants' approach to their interaction in a more structured way, just as P6 expressed. P12 stated that *"I did have an idea of what I wanted to compose but of course, I couldn't make it exactly how I wanted to. But I still had some sort of structure."* She further described her compositional plan as she *"wanted to start from the bottom and start from the low register of the notes and kind of expand something bigger and go back there for a second."* Similarly, P15 started composing with a structure and he expressed *"I gave a little bit of thought, ahead of time, about what the general shape I wanted it to be, but it was still mostly improvised."*

This creative process affected how the participants considered articulating their artistic intentions. Although some participants needed a longer exploration period to feel comfortable with the instrument, the creative practice affected their intentionality. P9 reported *"When I was composing, it was still more on the learning side, but I tried to be more intentional about the sounds I was making."* Even participants with experience in composition and choreography momentarily returned to a state of exploration. P11 shared that *"It was very wild to start making a composition with this brand-new relationship with the instrument. At the same time, I am very comfortable with performing in an unfamiliar situation. Sometimes, I forgot that it was a performance, but it was because of how exciting it was to explore."*

5.3.2 Performance as an End Goal

Although we value the creative process over the outcome in this research, many participants, especially those with composition and choreography backgrounds, reported that as they were interacting, they had real-life performance possibilities in mind. P1 stated that "[...] *since the beginning, I am already thinking of performance. How do I perform with this?"*

Although each participant performed with the instrument solo, we discussed different performance scenarios that the participants imagined playing the instrument in. Many participants reported that the instrument can be played as a *collaborative* or *duo performance* of a musician and a dancer. Some imagined it performed *solo* or in *music ensembles* with other string instruments. Other performance settings reported by the participants included *collaborative dance and theatre* pieces, duo performances with dancers,

musicians mimicking dancers in interdisciplinary settings, and accompanying other musicians in ensembles. Collaborative or duo performance suggestions ranged from multiple people simultaneously interacting with Bodyharp to sharing the same stage with other artists to create interdisciplinary work where Bodyharp's mapping not only controls sound but also other media. P5 imagined it as a *contact improvisation* or a *clowning* instrument and P11 suggested using Bodyharp as a movement-based art piece that supports *"the creative process in returning to a place of not knowing"* in dance teaching.

Some of the feedback from participants was employed in real-life performance situations. Figure 3 shows four case studies of performance with Bodyharp, following the results of the user study: Bodyharp was played in (a) a duo performance with a flautist, (b) a quartet with three dancers where dancers used Bodyharp's movement patterns as cues for choreographic events, and (c) a duo performance with a dancer, interacting together with the string and touch sensors, (d) as part of an audio-visual installation performance. The study of these *performance experiences in the wild* is beyond the scope of this paper. However, they show the potential of the creative practice with Bodyharp.

5.3.3 Repeatability

The repeatability of sonic and gestural motifs, phrases, and sequences appeared as a common theme across almost all participants. During the creative practice, we observed that the participants frequently returned to repetition of a subset of gestures. Some of these gestures were unique to their performers.

Participants also reported that finding sonic and gestural motifs that they can rely on their repeatability helped both their learning and creative process. P1, a dancer and a choreographer, reflected on her experience with repetition: "[...] *like having repetition, going back to the motif or themes that I found. Also repeating the same movement of my body with the sounds that I was creating.* [...] *I remember the feeling* [of one gesture] *and repeat it so that* [it] *sticks to the brain, that sound, that gesture."* P12 carried repeatable phrases to her composition as she expressed *"Instead of moving in space, I started to stay in one place, and I was trying to repeat musical phrases. I did try to do that* [repetition of musical/gestural phrases] *in the musical composition."* For P18, repeatability created a stronger sense of control and achievement. She reported:

> *"I felt accomplished when there was some motif that I could repeat. I felt a musical intuition, coming from my ability to play this instrument, that was nice. Finding a motive that way made me feel like I was playing a piece that I could come back to. Having some repetition material that is actually interesting to listen to. Same way with moving."*

We noticed that encouraging creative practice during the study supported participants in developing a sonic/gestural vocabulary that they could return to to create musical and movement compositions. It helped them to reflect on what they have learned with the instrument through repetitions and use such material to develop creative artifacts.

5.3.4 Movement Engagement

Although the instrument was originally designed to increase musicians' movement engagement, decoupling the musical and movement creativity allowed participants to explore new patterns of movement expressions. This decoupling is specifically important since the instrument intertwines sound-making and movement expression.

After the composition practice with the instrument in Step 4, some participants utilized the movement improvisation without the instrument in Step 5 as a way to explore new movement patterns. P10 saw this process as an iterative tool to explore new ways of playing the instrument through movement improvisation. She stated *"It seems like a good way of iterating how to adjust gestures. In the dance, I started to think of different ways of moving and I wanted to go back to the instrument."* P18 also reported similar experiences that during the movement improvisation, she *"noticed that when* [she] *was just responding to the music,* [she] *can access a whole new set of movements that is also responsible for creating music."*

Participants' movement engagement showed that reflecting on their creative practice through movement not only supported the exploration of developing new movement interaction but also revealed their interpretation between sonic interaction and body movements. An example of this interpretation was observed in interpreting reverberation and beating effects with finger or hand-waving gestures.

5.3.5 Sonic Awareness and Active Listening

> *"The sound carried through my body [...], I also felt very focused [...]. There was an interesting process of attentive listening. I had to listen more."*

As P4 expressed how sound-making with body movements affected her focus, many participants experienced a shift between their sonic outcome and their body movements. The participants guided their movements based on the sound they were creating. P11 reported that they were aware of "*making choices of letting the sound process through* [them] *and following the sound with movements; other times, doing the opposite of* [what] *the sound offers."*

Similarly, P6 was focusing her attention to the sound-making: *"I was making big gestures but I wasn't thinking of the gestures, but I was thinking about how it sounded. It was making me move without really letting me think about how I was moving."* Participants' focus on their listening also increased the expensiveness in their movement, potentially supporting their movement engagement.

This active listening process also helped the participants with connecting to their bodies. P15 expressed *"I felt like the movements that I made when I was making the musical statement were more connected to the sound [...] than the movements when I was interpreting the musical statement. I connected more physically when I was also making sound than I wasn't."*

6. CROSS-DISCIPLINARY INTERACTIONS

We observed that the creative practice allowed participants to refer back to their artistic backgrounds while creating sound and movement compositions. The interactions between the sound and movement domains allowed participants from either discipline to transfer their experience in artistic practice into movement-based music-making while learning from the other artistic domain.

6.1 Choreographic Tools

Choreographers reported their considerations for the audience and how the performance can be perceived from their perspective. P1, a dancer and a choreographer, stated

Figure 3: Bodyharp's performance practices were developed based on the participant's feedback and reflections, showing (a) a duo performance with a flautist, (b) a quartet with three dancers, and (c) an interactive duo performance with a dancer, (d) an audio-visual installation performance. In dance performances, the instrument was both played collaboratively with a dancer, i.e., musician and dancer interacting with the sensor and the string interfaces, and played with four dancers, i.e., the musician offering choreographic cues to the dancers with her body movements.

"since the beginning, I am already considering performance. How do I perform with this? How does the performance look from outside?" Similarly, another choreographer, dancer, and improviser (P11), reflected on their creative practice and expressed *"I was considering what makes a composition good composition or whether I wanted to create a good composition."* where she applied some of the choreographic tools to playing the instrument: changing height levels, adjusting the direction to face the body, and following the sound or opposing what the sound suggests.

6.2 Compositional Tools

P15, a composer, shared composing with Bodyharp was different from his regular composition process: "*I was thinking of different things when I do not normally think about in composition."* Instead of considering *"notes, harmonies, and specific rhythms"* as compositional materials, he stated that he was *"almost entirely thinking of gestures, both musical gestures and physical gestures. It wasn't so much of specific sounds [...], but the shapes of those sounds."* He further expressed that he would like to incorporate this approach to his compositional process.

A dancer who is also a musician, P12 described her vision for the performance which included *"starting with loudness and craziness and then quite and then one string. You just focus on that one string. And it expands from there again and goes away. That came to me in that moment."* Her approach showed that creative practice in one domain can support another domain when the connection is built through the instrument. She reported that *"for the dance, knowing what I wanted to do musically, I knew how I wanted to move* [to the dance]."

7. CONCLUDING REMARKS

In this paper, we study how creative practice can be utilized as an evaluation method and how developing this practice as part of the user study affects participants' interaction, creativity, and experience, in the context of movement-based musical interaction. This musical practice aims to encourage the creative thinking process for increased longevity, exploration, and creative utility.

We studied this creative practice by guiding the participants through learning and practicing with the instruments, allowing them to construct creative artifacts (as music and movement compositions, sonic and gestural vocabularies), and supporting their reflection on the practice through embodied, soma-based evaluation methods such as defamiliarization, movement explorations, or non-verbal recollection. Our analysis revealed five main themes for understanding participants' creative process and for aesthetics-based evaluating their interaction: increased focus on creativity, performance as an end goal, repeatability, movement engagement, and sonic awareness and active listening.

7.1 Limitations and Future Work

The creative practice encouraged future collaborations between the participants and researchers (see Figure 3). These performances were co-developed based on participants' reflections following the study and show that the evolution of creative practice positively impacted realizing real-life performance opportunities. We recognize that a longitudinal study, similar to Reimer's research [41], would provide a more in-depth understanding of how integrating creative practice as an evaluation method supports sustained use and long-term artistic practice with Bodyharp. Moving forward, we plan to study artists' long-term practice with the instrument and compare how their practice evolves. The researcher's role should be acknowledged due to their active participation in the design process. Although they remained as an objective observer during the study, some participants also occasionally needed clarifications from the researcher. We also recognize the laboratory setting for the current study's creative practice development as a limitation compared to *performance in the wild* cases [3]. However, we note that integrating creative practice can still offer more naturalistic, aesthetically informed, and holistic evaluation methods for NIME researchers who wish to extend their qualitative and quantitative evaluation approaches.

Ethical Standards

All participants provided informed oral consent and voluntarily participated in the study. The oral consent is collected according to Stanford University's necessary IRB approvals on nonmedical human subject studies with the e-protocol number 59665. The participants were informed about how we plan to confidentially use the data for academic and artistic purposes. The research is partially funded by the Center for Computer Music Research and Acoustics' research funds and Graduate Research Opportunity funds from Stanford University.

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