

# Move to Design: Tactics and Challenges of Playful Movement-based Interaction Designers' Experiences during the Covid-19 Pandemic

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## ABSTRACT

Design practices targeting playful movement-based interaction are changing rapidly with both technological and societal developments. In this paper, we provide a snapshot of movement-based interaction designers' experiences during the Covid-19 pandemic, by interviewing designers working in diverse roles that integrate physical human body movement and digital technologies (i.e., exergame and wearable game designers, playground and landscape architects, sports and dance trainers, and Sports-HCI professionals). Using grounded theory, we have identified two tactics from the designers' experiences: (i) the significance of face-to-face embodied interactions throughout the entire movement-based interaction design process, and (ii) the importance of positive, yet critical, attitudes to technology for designing bodily experiences, including mixed use of non-technical materials and tools for rapid prototyping and iteration. However, it was evident that such tactics are often not feasible without physical interaction between the designer and users. The restrictions imposed by Covid-19, therefore, further revealed the importance of body movement to designing a playful movement-based interaction – from ideation to execution and testing. This paper offers a worrying view of movement-based interaction design during the Covid-19 era, while calling for further investigation to enrich the discourse that could contribute to this field, possibly also beyond the circumstances of the Covid-19 pandemic.

## CCS CONCEPTS

• **Software and its engineering** → **Interactive games**; • **Human-centered computing** → **Human computer interaction (HCI)**.

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## KEYWORDS

Movement-based Interaction, Interactive Games, Interaction Design, Embodied Interactions, Design Process, Qualitative

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## 1 INTRODUCTION

One of the major trends of Human-Computer Interaction (HCI) research, spanning multiple decades, is the expansion from desktop interfaces to embodied experiences. This development has been motivated by values within movement-based interactive design disciplines, such as increased naturalness of interaction [65] and health benefits brought by physical activity [1, 50]. From early systems research such as Krueger's artificial realities [29], the field has progressed to various innovations in interaction techniques (e.g. [2, 11, 28]), experimental novel applications [17, 24, 41] as well as novel concepts (e.g. [39, 48]), guidelines (e.g. [46]), methodologies (e.g. [22, 23, 38, 44]), and frameworks for designing for the moving body (e.g. [18, 34, 36, 45, 51]).

All these standard knowledge forms are typically abstract from the particular and are usually packages to synthesize design knowledge – e.g. in the form of guidelines, frameworks, and methods. However, fewer works focus on articulating practice-based knowledge in the field, for example, how design practitioners interpret the methods into their practices in day-to-day process (e.g., choice of techniques, design, aesthetic). We argue that understanding such expertise of movement-based interactive designers is crucial for informing research on design tools and processes, and for educating new generations of designers in emerging disciplines.

Furthermore, the field of designing playful experiences for the moving body is undergoing a rapid evolution. Take climbing, for example. Emerging technologies such as augmented reality (AR),

have given rise to playful novel climbing activities [25]. Climbing is also getting much attention and social recognition to the point of being accepted to the Olympics held in 2021. Such increased interest has created a new demand for professional climbing routes and environments, which led to the emergence of route design as a design profession (e.g., [9, 12]). Similar developments can be observed in parkour, which has recently been rising from a fringe activity to a widely adopted hobby [57], creating demand and opportunities for professional parkour playground and gym design. The contextual contingencies that were brought by the Covid-19 pandemic are also likely to further challenge the designers of playful movement. Considering these perspectives, and documenting current design practice and challenges, this paper advances research on movement-centric design and designers' experiences, and contributes towards a better understanding of opportunities for supporting designers with novel tools and methods.

### 1.1 Context: Designing moving of body

Empirical studies in the field of human-computer interactions have established the benefits and impact of bodily interactive experiences [10, 33, 64]. Further, existing design research has long established the importance of focusing on and leveraging the moving body when designing for movement-based experiences (e.g. [20, 21, 34]). Many works have also focused on illustrating how human bodily experiences can be brought into the digital world and/or vice versa (e.g. [3, 53, 61]). Notably relevant are innovative applications and scenarios, like exergaming designs and studies in the field of sports HCI, which share a mutual focus on embodiment and user engagements [13, 41, 47, 59]. Such applications tend to provide designers with practical tools for design, such as frameworks and methods to harness creativity and bodily engagement (e.g., [36, 38, 40, 49]). Literature that suggest and explore the design for user-participatory interactive experiences were also reviewed [26, 27].

From the perspective of design studies, the process of designing is not always a linear ascending procedure but rather seen as a complex and constant conscious effort in both action, perception, and recognition [5, 31, 32] – the cycle of defining the problem, producing, testing, and refining for further improvements. Here, design is acknowledged as a problem-framing and solution-focused way of thinking [5, 14] inspired by experience of practices [31, 52, 58] rather than systematic formula. Such views that acknowledge design as an iterative cycle have been implemented in various disciplines, including architecture [7], engineering [8], and game design [63]. More specifically, Salen and Zimmerman have also famously mentioned that game design is a second order design activity [60] that the activities are performed by the participants, and not under full control by designers (also see [30]). Here, designers can only directly affect mechanics – which elicit dynamics in interaction with the user(s) and the aesthetic experience arises [54].

### 1.2 Research objective

In this paper, we use grounded theory as a methodological tool [42, 56] with semi-structured interviews from movement-based interaction design professionals (n=11) working in diverse and emerging design roles: wearable and exergame designers, playground and landscape architects, sports and dance trainers, and Sports-HCI

professionals.<sup>1</sup> Here, we look into how the design professionals practice their design by investigating the following questions:

- What are the tactics that movement-based interaction designers use, and the challenges that they face?
- How is the Covid-19 pandemic affecting their design experiences?

## 2 METHODS

### 2.1 Data

The potential interviewees were personally contacted by the author(s) according to the individuals' expertise. Here, individuals with professional expertise in bodily movement design who also use digital technologies were prioritised (i.e., interactive displays, motion capture projectors, wearable trackers or communication devices, installations for location-based games or play).

In total, 11 participants were recruited for a semi-structured interview (see Table 1). Interviews of nine participants were conducted on 1:1 basis, while the other two (E1 and E2) chose to do a group interview as both are working together. Six participants were also affiliated (either full-time or part-time) to a university or research institution at the time of the interview, while two were working full-time as game designers. Additionally, seven participants also had professional background as physical trainers (e.g., dance, yoga) and/or active performers with semi-professional level skills (e.g., sports climbing, dance). All participants were currently located within Nordic European countries but had diverse ethnic backgrounds: Europe, Middle-East, and East Asia.

Two lead authors conducted the interviews. To conform with the multidisciplinary background of our participants, interviewers were encouraged to reflect the vocabularies used by the participants. For example, in the following open-ended question about the participant's design process: "*Let's talk more about how you design the movement,*" the term 'design the movement' could change to 'making moves,' or 'design interactive games' depending on how the participant described his/her design process earlier during the interview. Also, the interviewer tried to use common design terms (e.g., 'prototype,' 'test') and casual sentences (e.g., "how do you tryout?" "how do you know if that works or not?"). Finally, the interviewer skipped questions that the participant had already covered. The overall interview questions were themed as follows:

- Educational and professional background of the participant
- Insight and preparation: Where do the ideas (inspirations) comes from?
- Incubation and illumination: The design process of current project and/or recent previous project(s) during the Covid-19 pandemic
- Verification: Testing and iteration process of current project and/or recent previous project(s) during Covid-19
- Reflecting previous projects: Failed attempts and why
- Insights for future projects: Ideal envisioned design process and why

<sup>1</sup>Note that some of these individuals did not self-identify as 'designers' as such, but since they all work professionally on planning, designing, guiding, and acting in bodily engagements, in this paper, we refer to them as *movement-based interaction designers*

**Table 1: Summary of the participants' expertise, years of working in the design field, and gender**

ID	Expertise design fields	Years of experience	Gender
A	Interaction designer and researcher, dance and fencing trainer	16+ years	Male
B	Interaction designer and researcher, movement for teaching	4-6 years	Female
C	Spatial design, mixed-reality, interactive parks and playgrounds	16+ years	Male
D	Game technology researcher, wearable games	7-9 years	Male
E1	Game designer, exergames	1-3 years	Male
E2	Game designer, exergames	1-3 years	Male
F	Play designer, playground, interactive spatial design	10-13 years	Male
G	Group trainer, interactive design research	1-3 years	Female
H	Interaction designer and researcher, Sports-HCI	16+ years	Male
J	Dance teacher, online teaching	16+ years	Female
K	Landscape architect, dance performance	1-3 years	Female

Verbal consents were received from all participants. As all participants were either in partial lock-down or under public gathering restrictions at the time of the interview, nine interviews were conducted online using Zoom<sup>2</sup>. The remaining two interviews were conducted offline upon the participants' request, while following the Covid-19 safety regulations. Nine interviews were conducted in English while two in the participants' (and one of the lead author's) native language – which were later translated into English for analysis. All interviews were recorded and transcribed.

## 2.2 Analysis

The author(s) took an inductive approach and focused on patterns that naturally emerged from the interview data [15], focusing on the coherent patterns that emerged from the data while interpreting the context and nuance of the interview by reflecting on the participants' professional background and expertise [4, 55].

In the open coding phase, using the qualitative analytic software Atlas.ti 8, the codes were developed by one of the lead authors without specific predetermined analytical categories or hypothesis-driven code sets [16], to focus identifying coherent patterns from the data to interpret the meanings within. Such codes were later discussed with one of the the collaborating authors, who also independently re-grouped the open codes to validate the interpretation. In total, 127 open codes were identified. Then in the axial coding phases, we discovered relationships between the Covid-19 restrictions, designers and users' bodily engagements, choice of technology, and the designers' own values and norms in design, while focusing on whether these factors are (a) associated with each other, (b) cause of other(s), (c) part of other(s), and/or (d) countering each other.

## 3 RESULTS

### 3.1 The moving body

Our participants described how they try to engage with their users (in which the users may be described as, e.g., players, participants, or testers) physically throughout all levels of their design process. This includes performing bodily movements in front of the users

or inviting users to the designer's workspace to move physically together. These physical interactions with the users interplayed in all aspects of our participants' design process, from define (of problem), ideation, prototype, to testing (of design). Furthermore, bodily engagement was accepted as the most effective way amongst our participants to identify the problem and find inspirations for the solutions. For example, interactive designer B described the importance of exploring with tangible objects – exploring the affordances of the object, how it feels, and how it affects the bodily senses – when designing a wearable device. The crucial aspect of this process of movement design is, according to B, is that the designers and users have to “deep engage” with the material (e.g., wearable watch mock-ups, plastic bandages) to explore its potential and usability. Other participants described several ways to integrate movement during ideation, using words such as “playing with it,” “test it out,” “move around (with it),” etc.

*The goal was like, a deep engagement with the materials. A deep engagement with the practice and try to explore through that engagement and possibilities for new technologies. Or possibilities for new area experiences (B:20).*

Physically engaging with the users entails certain sensitivities and strategies to the designers. Our participants often described how frequently they had to *improvise*, and work around peoples' irregular behaviors (e.g., freezing, being passive or too active, expecting too much or too less). They also needed the ability to be immediately responsive to users, which allowed for adjustments to fit better the users' physical capacities, limitations, and motivations. For example, exergame designer E2 said they tend to try responding to their players by fixing their (game) designs as promptly as possible. Furthermore, to minimize the risk of unexpected behavior of the user later in the process, our designers generally agreed about the importance of testing with their primary target users in a physical space – ideally from an early stage.

*We constantly do small improvements to the games. It has happened. I think many times. We were even able to update the games (remotely) through the internet. We can do these fixes and adjustments to the games (E2:42).*

<sup>2</sup><https://zoom.us/>

Some participants described their tactics of *mirroring* when they communicate with their users. For instance, E1 (the exergame designer building climb wall game) said that he/she witnessed a drastic behavioral difference between those individuals familiar with the platform (climb wall) versus those who are new to it — some users can perform their movement, others might not. This was especially the case of those design projects that are offered in the form of timely and physical manner (e.g., group training, stage performance, interactive installment operating in a specific location). To motivate those who are reluctant to move, the designers tend to subtly empathize and imitate the users' intentions and bodily language — mirroring their physical and verbal movement (see also [43]). Interaction designer A described in detail how they value physical interactions with the users in order to “feel” the tension in the users' body muscles so that he/she can replicate that tension. This, according to A, was vital to give a more explicit visual demonstration of how to perform body movement. Some even adapted the user's own language (e.g., vocabularies, nuance). As such, being able to *empathize* the users' cognitive and physical condition was vital at this stage of movement-based interaction design.

*So be part of it and move yourself literally. (...) Part of it is social, make people feel willing and trusting to work with you (A:13).*

We also noticed that our participants often visually expressed their excitement (e.g., smile on their face, larger gesture, etc) during the interview when describing how they enjoy physical and emotional engagement with the users, preferably on face-to-face conditions — often using the terms such as “(feeling) trust,” and “(establishing) social bond.” From this notion, many described the significance of ‘soft skills’ in their movement-based design process more so than their technical skills or techniques. The online dance trainer J, for example, was highly expressive about the feeling of togetherness through bodily engagement with the students; asserted the pedagogical value throughout the interview, and how much the online dance training during the Covid-19 pandemic offered personal impacts to both the designer themselves and the students (users), despite it was remotely conducted in virtual space.

### 3.2 Technological tools

We noticed that our participants were generally enthusiastic about new technology and techniques from emerging disciplines (e.g., AI, HCI, wearable). Yet, they tend to be cautious and strict when adapting digital technology for their movement design. Here, our participants tend to carefully assess the tools based on its affordances; the capacity of the tool to generate and cater to physical movements, and whether the tools (or materials) were wearable, portable, and light to carry.

In contrast, to our surprise, VR was mentioned by multiple participants as the least movement-friendly digital tool for ideation, and thus, not practically feasible to movement-based interaction design. The playground designer F, for example, said that when someone in the team brought up the idea to create a visual mock-up with VR, he/she immediately discarded the idea as it was not compatible with the physicality that the team was aiming for. The dance trainer J said video conferencing would not be replaced with VR, as J's users (students) would have difficulties in sensing and socially engaging

with each other (e.g., unable to identify facial expression or bodily response lively, whether the student is having a bad day or not). This shows that movement-based interaction designers' needs for lively physicality is high, particularly on whether the digital input and output devices in question can cope with the analog bodily activity envisioned in his/her design.

*(My team) were thinking, 'should we make some kind of VR implementation so we can see it?' And I said 'no, we shouldn't.' (...) The big reason for that was because, we wanted to get a feeling and a physicality (F:41).*

Instead, many participants prefer developing analog mock-ups using traditional non-digital materials that are affordable and able to be manipulated (e.g., fabric, hoops, paper, pen, and cardboard) — both before and during the Covid-19 pandemic. There were several strategies to create these mock-ups, the main of which involves focusing on one embodied core mechanic [35] the design should support a simplified essential physical action. This could be actions such as jumping, tapping, rotating certain body parts, or orienting the body in a particular way. For example, interactive designer B said their recent mock-up combined marbles and transparent tubes, which aimed to imitate accelerometers to measure the users' upper hip balance — and observing their behaviors leads to inspiration for the next prototypes. However, despite general enthusiasm towards new technologies and affordable mock-up building, we noticed most of the participants could not continue with their non-technical prototyping methods during the Covid-19 pandemic. The limited access to physical resources, time, and budget were mentioned as major obstacles.

*(I used) weighted balls that kids play with. So with marbles. Depending on how they were moving, I was attaching the tube to the hips. And of course depending on how the person was moving, they could feel the marbles falling to one side or the other. So with that (mock up) I could explore, a haptic possibilities, on how this type of haptic feedback would feel (B:35).*

### 3.3 Dealing with the Covid-19 pandemic

Without surprise, data suggest our participants were not very well prepared for a sudden societal impact by the global pandemic of Covid-19. Restrictions in physical interaction have indeed put immense pressure on all aspects of movement-based interaction designers, despite their general enthusiasm towards digitalization and interactive technologies being intact. This was especially challenging for participants as the physical interactive engagement with the users is crucial for their interactive design process — from problem-defining to execution. The exergame designers E1 and E2, for example, described that almost all of their projects had been postponed since the beginning of the pandemic, as their daily work routine involve playtesting with indoor facilities (e.g., trampolines, climbing walls with motion sensors), which are crucial for their game design, ideation, and development. Other participants' work conditions were at a similar stalemate.

*I would say this product was strange due to Covid. (...) It affected a lot. Because we had a lot of testing with children planned that wasn't possible to do (F:48).*

Interpreting the movement of the users for iteration, were also mentioned as a challenge during Covid-19 due to difficulties in an adequate documentation practice to interpret the user's physical response movement — which could be highly dependent on the context of the users, the atmosphere in the physical space at the time of the movement, etc. Most of our participants said they could not easily observe, record, or decode their users' movements during Covid-19 when physical space for interactions was highly restricted. The wearable designer D and other participants said that although the method of video recording was already common before the pandemic, their project still had to undergo a major planning revision regarding practicalities and equipment. Furthermore, administrative procedures to ensure both users' and designers' safety also intensified the complexity of our participants' work. While some of our participants tend to perceive these unexpected encounters as a learning experience, the stress of uncertainty was present — with fatigue and daunting activities throughout their design process.

At the same time, there were some viable tactics for dealing with the contingencies of online work. One of our participants was actively seeking new solutions and learning during this pivotal moment. The online dance trainer and designer J, who was recruited especially in light of their actions online teaching approach, once used to be a regular dance trainer but recently converted to the profession as an online-training expert during the Covid-19 pandemic. Its users — in this case, teenage students — had to be instructed entirely through video calls at their homes, which were much smaller than the original dance training space.

From there, the designer J quickly adapted to this new design constraint of the limited size of the physical space with three pragmatic approaches: (a) redesigned the training session by reducing the frequency of active actions (e.g., jumping, running) but instead concentrating on relatively subtle actions, so that the students can move accordingly even inside a cramped apartment, (b) to instruct the users while facing them through the camera as the trainer can no longer stand side-by-side next to the students as in the real world, (c) offering more personalized guidance and attention to the student to remind the feeling of being together — in which, being able to see all the users' videos side-by-side on the screen helped focus on details on students' movements, and lastly (d) to better empathize with the physical setting of the students, the trainer replicated this setting by moving their own workspace also to their apartment to ensure similar conditions and prevent the use of exercises that require too much space. We noticed such tactical practices also correspond with our participants' emphasis on the ability to empathize (cf. Section ??), of which the designers were highlighting the "trust" and "social bond" with the participants for the quality of their design.

*(Through camera) I could see the students better than in the real world, because they all have their own tiles in my view. This allowed me to view a single student for a long time and give more personalized guidance. This was extremely important to the students, that I gave them attention, called them by their names and everything that make it feel like we're doing things together (J:13).*

*It's also easier that the teacher is also in a small space, which helps in managing and understanding the spaces of the students. So that the choreography doesn't become something the students can't execute at home. This is why I was teaching from home all the time. I tried a few days teaching from a dance classroom, but I realized it's just crazy. Even though I was setting boundaries for my space, my hand could cross the boundary and then at home one would hit a wall. (J:47)*

Understandably, but unfortunately, most of our participants struggled with delay and lack of productivity in their existing practices. Other than the exceptional case of the online dance training designer J, all our participants were largely still in practices they were familiar with from pre-Covid time, working on temporary (substituted) projects that are likely to be reset, discontinued, or merged once the physical interaction can happen freely again in the future. Considering the significance of physical and social interactions to most of the participants' design process — from define, ideate, prototype, and test — it seems evident that the Covid-19 pandemic has caused a dire impact on many of these participants' fundamental design approaches.

## 4 DISCUSSION

### 4.1 Embodied tactics

One of the design tactics that was emphasized strongly among our participants was to physically engage throughout the design process, situating the movement at the center of design ideation, development, prototype, and testing. This aligns with the existing case studies that captured the importance of physical movements when harnessing new creative and interactive movement design [49, 61]. Similarly, it appears that embodied ideation [38] is a viable tactic for immersive and engaging bodily experiences [40]. Another technicality that draws our attention is the tactic of *improvisation*. Data shows that our participants were capable of improvising and live redesigning of the product/project according to the users' body expressions. Our results also indicated the importance of the designer's technique to empathize and *mirror*, in order to interpret others' body movement and physical capacity. This adds to previous academic research [6, 19, 22] with an account of the importance for designers.

Interestingly, in contrast to Salen and Zimmerman's point that game design is a second order design activity — that the activities are performed by the participants, not under full control by designers [60, 62] — we find that in the practices of our participants, the movement-based interaction designer does not only set the rules and constraints but is always personally there carrying out of the activity. Especially given our insights regarding the tactic of improvisation as an immediate responsive interaction with users that these practitioners do, one could possibly argue that the designer kind of *does* "come with the box" — something which we believe deserves further thought and research.

To summarize, we see both of these two skills (improvisation and mirroring) are evidence that supports the importance of bodily engagements in designing movement-based interactions. Physical bodily activity is, in fact, not merely part of these designers' design outcomes, but more so the design process itself [20, 34, 37].

## 4.2 Technology driven design attitudes

For HCI design and research that combines body movement with technology, our data highlights how the designers might pay more attention to details and nuances that technology-driven representations of the body and the real world might neglect. We noticed that the emphasis on socializing with the users through design was strong among our designers, supporting existing studies [22, 37]. The participants showed a positive yet critical attitude towards adaptive technologies, carefully accessing the *affordance* on whether the tool or material in question is suitable for the design (and the processing of design) in vision. Participants were using a mixture of analog mock-ups using traditional non-digital materials (e.g., fabric, paper).

In contrast, there was a critical response towards VR technology from the movement-based interaction designers, e.g., as a remote/online teaching environment for dance. Despite the general excitement of future technology, our participants were less keen on adapting the new immersive technology, as the present VR devices are not ideal for conveying the subtle nuances of facial expression and posture that we utilize in recognizing mood and emotion. This aligns with other case studies on meaning-making while moving [3, 26, 27] where the mood and atmosphere are essential to produce engaging movement from the users.

It appears evident that the Covid-19 pandemic and the accompanying need for remote (online) work were an aberration, something to be acquiesced to due to a lack of alternatives. Most of our participant's experience around the physical restrictions seemed to be seen as temporary measures to be discarded as soon as possible to return to the old practice. When looking at the actual tactics that arose from the interviews, though, we feel that there is potentially more to be learned. The tactics employed might also contain lessons for more positive future developments (e.g. climate awareness might lead to a need for collaboration that is less travel intensive, thus mandating more remote work). A pursuit of inclusivity might lead to working remotely with people who cannot or will not join in person for activities. A drive to internationalisation of one's practice and an attempt to reach a more global audience, the same. All such developments would benefit from the further exploration of lessons learned from the remote work carried out by our participant during the Covid-19 pandemic – even without detracting from the validity of their wish to return to regular practice with its co-present, personal and bodily interaction that is so crucial in this domain.

## 5 LIMITATIONS

Our data highlights the high diversity of the movement-based interaction design experiences. Considering this, the diversity of our sample could clearly be higher – 6 out of our 11 participants are working at least part-time as researchers or are otherwise employed or funded by the public sector, and many have similar educational backgrounds (e.g., industrial design, human-computer interaction). Although the qualitative grounded theory approach did allow the author(s) to conduct an in-depth analysis of the phenomenon, the author(s) also aware that our report is a snapshot and does not account for the entire population of designers in similar disciplines. Methodologically, we also acknowledge that while our

free-form questions approach complied with the multidisciplinary background of our participants, it yet imposed challenges in retrieving concrete answers about the designers' source of ideas and practices. That being said, we should also ensure more focused questions are represented in consecutive inquiries. Furthermore, our research faced challenges throughout the participant recruitment, with a high number of potential participants who initially agreed for an interview but then did not show up or stop responding. The author(s) suspect that the Covid-19 pandemic and its forced online-only interview situation might have negatively affected recruiting individuals who value physicality and real-world engagement. Therefore, future work is needed to validate and extend our results, focusing on the perspectives and experience of interactive designers from various other educational and professional backgrounds – such as those from physical training and performances, inquiring what human-computer interaction researchers and professionals could also learn from the experts from those areas of interest.

## 6 IMPLICATIONS AND CONCLUSION

This paper reported the experience of movement-based interaction designers during the Covid-19 pandemic, through data gathered from the 11 designers working in diverse roles that integrate physical human body movement and digital technologies. Here, we wanted to snapshot the recent status and tactics of movement-based interactive designers to inform research on design tools and processes for future implications. Followed by qualitative analysis, the paper identified two patterns from the designers' experiences: (i) the significance of face-to-face embodied interactions – including tactics of improvisation and mirroring – throughout the entire movement-based interaction design process, and (ii) the importance of positive, yet critical, attitudes to technology for designing bodily experiences, such as mixed use of non-technical materials and tools for rapid prototyping and iterations. We also noticed designers still tend to favor non-technical materials and tools that can generate and cater to physical movements (i.e., paper, cardboard) more suitable for rapid hands-on prototyping and iterations. Lastly, the restrictions imposed by the Covid-19 pandemic further revealed the importance of body movement to those designing movement-based interactions – an essential and irreplaceable design inspiration.

Some technologies including virtual reality were less favored, due to the risk of restricting bodily movement and social interactions—despite the participants generally sharing an enthusiasm towards new technology. This was a surprising result from the authors' perspective, as we considered movement-based interaction designers as highly adaptive and familiar to new and emerging technologies and thus able to find alternative tactics. This reflects something particular nature about bodily engaging in movement-based design, which is worth for further research. And, while it is evident that the Covid-19 pandemic has been an aberration, the challenges imposed by it may able to evoke new explorations and positive future developments – perhaps, a drive for new design alternatives or enhancement of accessibility beyond geographical distances. From there, we argue that the experience of movement-based interactive designers should be further documented and explored even beyond the Covid-19 era. We encourage further academic inquiries and empirical explorations of the fundamental particularities of

the bodily engagement interactive design, to enrich the discourse on alternative solutions and the rapidly changing landscape of the discipline.

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