

Movement-Based Game Guidelines

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ABSTRACT

Movement-based digital games are becoming increasingly popular, yet there is limited comprehensive guidance on how to design these games. We present a set of guidelines for movement-based game design that has emerged from our research-based game development practice. These guidelines have been examined and refined by 14 movement-based game design experts with experience in the academic, independent and commercial game development domains. We contextualize the guidelines using current findings about movement-based game and interaction design, taken from both published research papers and game design venues. Our primary contribution is a body of generative intermediate-level knowledge in the design research tradition that is readily accessible and actionable for the design of future movement-based games.

Author Keywords

Movement-based games; whole-body interaction; play; digital games; exertion

ACM Classification Keywords: H.5.2. [Information Interfaces and Presentation]: User Interfaces - Miscellaneous.

INTRODUCTION

There has been a recent increase in the number of movement-based games, i.e. digital games in which gross-motor bodily input influences the game’s outcome [31]. This trend has been fueled by advances in sensor technology, incorporated in game console systems (e.g. Microsoft Kinect, Nintendo Wii and Sony Playstation

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Move), but also in mobile phones that can sense limb and body movement. Researching these games is important, as they can offer mental, social and physical health benefits [15, 17, 24] as well as entertainment opportunities [3], but also expand the design space for digital games [30, 31].

Movement-based games align with a larger trend in HCI around embodied interactions [10] that put the body in the center of the interactive experience. However, proponents of this trend have lamented that there is a limited understanding of how to design such experiences [1, 19, 31]. Researchers have pointed out that there has been progress on higher-level theory in the form of frameworks and abstract concepts [31]. However, what is still missing is intermediate-level knowledge in the design research tradition [13, 18, 47] that designers can use in their practice for creating these systems [19].

Such design knowledge could help game designers avoid previously identified pitfalls. It could also provide them with a structured approach to engage with movement-based game design, as well as opportunities to learn from other people’s experiences. All this will result in higher quality games, advancing the field, and consequently supporting players in profiting from the benefits associated with playing movement-based games.

In this paper, we present intermediate-level knowledge in the form of practical guidelines for the design of movement-based games. These guidelines have emerged from our combined 20 years of research-based game design practice and engagement with the movement-based game field. The guidelines have been examined and refined by 14 movement-based academic, independent and commercial game design experts. The result is a readily accessible and actionable body of generative intermediate-level knowledge for the design of future movement-based games. We also present insights from our approach of generalizing practical guidance from design-research practice and surfacing associated tacit knowledge [35] from expert designers.

GUIDANCE FOR GAME DESIGNERS

Academic papers often aim to provide designers with abstract frameworks that can then be applicable to game design (for example see [3, 4]). Less theoretical guidance

for game designers often comes in the form of books that offer a set of lenses through which to examine one's practice [12, 38]. Recently, alternative formats have emerged that aim to narrow the gap between theoretical frameworks and the design practice, most often in the form of design cards [33, 37]. Evidence suggests that these practice-oriented approaches can indeed support the creative process [19].

Most of this practical guidance, however, focuses on interactive systems in general or games in particular, but not on movement-based games. Prior works argue that designing movement-based games is different than designing button-press games [31]. There have been attempts to highlight the challenges and opportunities for designers of these games [15, 43]. However, they either focus on abstract frameworks [29, 31] or emphasize individual aspects of movement-based gaming experiences, such as health benefits [5], affective responses [6, 24] or social benefits [28]. What is missing is a comprehensive understanding of how to design these movement-based games, presented in a format that matches the practice-based focus of the game design field. In response, we present a set of guidelines for movement-based games.

OUR APPROACH TOWARDS DEVELOPING THE GUIDELINES

We developed the guidelines through the following process.

Reflection on academic work and achievement

First, we reflected on existing literature on the topic of movement-based game design as well as on our own prior work, which includes 20 years of combined experience in this field. This body of work includes several award-winning games, including games winning and being shortlisted at venues such as Indiecade, Mindtrek, the European Innovative Games Award and the Fun and Games Award. Our games have also been exhibited at international game festivals (Freeplay, Indiecade East, etc.), and international conferences (CHI Interactivity, Fun and Games, DiGRA, etc.). We also reflected on our teaching on movement-based games. In total we taught 6 classes and 5 workshops and game jams on this topic. Lastly, we visited each other's labs to gain insight into our design and teaching practices around movement-based games.

Analyzing notes

We then compiled the generated notes, looking for overarching themes and commonalities. We worked on these notes individually before we discussed them together, which was an iterative process over 2 years of ongoing conversations. This included discussions face-to-face, where we used our bodies not only to play games we had at hand, but also to mime games that we knew about to articulate our arguments. These discussions continued online when we were back at our respective labs, where such bodily discussions were much harder. This experience reminded us of the challenge to communicate guidelines

about movement-based games without having people move; in response, we decided to incorporate many examples that we suggest readers should play (if available) while using the guidelines.

Website and feedback from the labs

We believed the best way to reach our target audience was to make the guidelines available online in a manner similar to other design guidelines (such as [2, 16]). We created a website and showed it to our lab members to get feedback on both content and presentation, asking them first for verbal feedback in a group setting, then individually. We took notes during both rounds of feedback and presented the findings again to the group members.

Feedback from experts

After the compilation of the guidelines, we sought feedback from movement-based game design experts to refine our findings, and ultimately, to substantiate our claim that these guidelines can be perceived as useful by game designers.

Participants

We recruited 14 movement-based game design experts from our network, including a) commercial designers and user researchers, as commercial practitioners probably develop the largest volume of movement-based games today, b) independent game designers, as they are able to explore novel game design ideas without the marketing constraints of corporations, and c) teachers and researchers, as we were also looking for feedback from an academic perspective. All have experience designing movement-based games and/or have supervised and taught designers of movement-based games. All have extensive experience in this young field; one practitioner was keen to point out that he was *"in this field from the very beginning"*.

Here is a breakdown of the backgrounds of interviewees:

Commercial:

- Design lead, Dance Central 3; designer, Dance Central 2 at Harmonix.
- User research lead, Dance Central and Kinectimals at Microsoft Game Studios.
- User researcher, Just Dance, the Michael Jackson Experience, Your Shape and Fitness Evolved at Ubisoft.
- User researcher, Sony's Eyetoy games, Singstar and Sports Champions at Sony.

Indie:

- Co-director of the Come Out and Play Festival; instructor of the Big Games class at the Interactive Technology Program at New York University; creator of many commissioned games.
- Director of Indiecade East; designer of Recurse, a commissioned movement-based game that is also released on the iPad.
- Creator of Indiecade finalist game Hit Me; Eyebeam fellow; instructor of Beyond the Joystick.

- Curator of physical game exhibitions including Street Level; game educator and co-founder of Kokoromi game collective.

Academia:

- PhD student in game design, Co-founder of w00t play festival, member of Copenhagen Game Collective.
- Associate professor in a design faculty, artist with many award-winning movement-based installations.
- PhD student in game design, co-director of indie game collective, curator of games arcades and exhibitions.
- Associate professor in a design faculty, coach of many student design projects involving tangible and movement-based play.
- PhD Student in Games and Motivation, Game Jam organizer Games4Health Jam, Game Jam CHI.
- Recently finished PhD on dance game interfaces, currently a game designer for Microsoft Studios.

Procedure

We asked the experts to examine the guidelines in their own time and reflect on them. Several experts took notes during this process that they brought to the interview, which we conducted either in person or via Skype. We asked for general feedback on the guidelines, such as whether they thought we had forgotten any, whether we could delete some, etc. We then went through the guidelines one by one, seeking specific feedback. Based on the experts' insights, we refined the guidelines, and emailed the refined version back to them to gather final feedback as to whether we were successful in implementing their suggestions. We pointed out that we aimed for a consensus approach, and were not able to implement every suggestion, as some were contradicting each other while others were too time consuming to implement.

Data Collection and Analysis

We interviewed participants individually for approximately one hour each. We recorded the session and also took notes. The interviews were almost evenly split among the authors. We each took notes on the recorded interviews that we did not attend. We compared notes and coded them, looking for repeating themes. We used these to refine the guidelines before sending them back to our experts for final feedback. The results are available at movementgameguidelines.org.

GUIDELINES

We now present 10 guidelines. We see these as a starting point tackling key concerns. It is of course possible to generate more detailed and refined guidelines, for example considering particular player target groups, game types and game genres. Other existing categorizations of movement-based games (for example see [32, 45]) might help in identifying further guidelines for more specific game types. Our guidelines aim to capture a range of games and players while providing concrete advice, i.e. we were aiming to be broad while also specific. By proposing guidelines we engage a constant balancing act between being too specific and too general, a challenge expressed previously in work

on design patterns [9] - design patterns were one of our inspirations as they have previously been used to articulate best practices in game design [8]. Engaging in this balancing act has distinct advantages and potential pitfalls for researchers, such as the guidelines being useful for a wide range of game ideas, yet not engaging enough for practitioners to use. Our aim was to hit the "sweet spot" between being too broad (and therefore not applicable and useful for practitioners) and too specific (and therefore resulting in guidance that practitioners do not read) based on our over 20 years experience.

Structure

The guidelines are grouped into three categories. Each guideline has a short heading to make it easy to remember, phrased in language we hope appeals to game designers, followed by 2-3 sentences that explain the guideline in more detail. We also included example games that illustrate each guideline in practice and a set of strategies to help designers apply the guideline. The final part offers advice on what designers should and should not do. Many of these advices come from our teaching practice, and were further refined by our experts. Due to space constraints of this paper, we abbreviated many of the guidelines (full guidelines are available online) and limited the amount of example games presented. We also added more scholarly context to each guideline.

GUIDELINES: MOVEMENT REQUIRES SPECIAL FEEDBACK

Embrace ambiguity

Instead of fighting the ambiguity of movement, embrace it.

Ambiguity in movement-based games arises from the fact that no two movements are the same, and most sensor data is messy. Trying to force precision may only frustrate the player, and make the limitations of the sensor obvious in a very un-fun way. So instead of trying to remove this ambiguity, work with it: players enjoy surfing uncertainty and trying to figure out optimal strategies in a somewhat messy system.



Figure 1: Pixel Motion

Pixel Motion (Fig. 1)'s movement sensor is a surveillance camera that picks up overall motion flow patterns instead of tracking individuals. This allows for a group interaction with a 'more the merrier' feel to it. Anyone in the camera's field of view can join in 'wiping' pixels off the video feed by moving around within the play space. The lack of system coupling with individuals means that people watching feel more free to jump in and interact, which helps everyone succeed. The game takes advantage of the sensor ambiguity to encourage group play.

Strategies for Designers

- Get to know the limits of your sensors, and use these limits as a design resource.
- Construct the player's actions in a way that gives room for sensor error without drawing attention to it.
- Avoid game mechanics that require precise control.

DOs and DON'Ts

DO use the ambiguity of movement and sensor data to enhance the game.

DON'T use buttons during the early development phase (even if it seems easier), as you will miss the opportunities arising from dealing with ambiguity.

Additional references (not in guideline)

HCI research has previously highlighted the potential of ambiguity to contribute to an engaging experience by giving the user opportunities to "fill the gaps" [14]. We draw on this idea and remind designers that movement is inherently ambiguous due to the many degrees of freedom inherent in movement. This, combined with the fact that most movement-sensor data is far from precise [4], makes for experiences filled with ambiguity. Designers can try to reduce this ambiguity, for example reducing complex movement to simple gestures [5] or refining sensor capabilities (such as done with the Wii MotionPlus); however, we encourage engagement with ambiguity as a resource for design as well [14, 43].

Celebrate movement articulation

Celebrate how well players articulate movement, and the joy of movement, by giving feedback on movement quality moment-to-moment.

In button-press games players get feedback if and when they press a button. With movement-based games, it is not just if and when, but also how movement is performed. Also, you are not always performing movements to achieve an outcome. Sometimes movement can be enjoyable on its own (whereas pressing a button is not usually a noteworthy pleasure for the player). Therefore celebrate the joy of movement and its articulation by providing players with feedback on the quality of their movement. This feedback has to be instantaneous, so that players can improve their movement articulation moment-by-moment.

Example: Dance Central 2 celebrates movement articulation with bright smooth streaks on-screen when the quality of a dance move is "flawless" compared to the dance instructor.

Strategies for Designers

- You need not judge articulation, you can just provide feedback by highlighting players' articulation to allow them to reflect on and learn from it by themselves.

DO's and DON'Ts

DO provide feedback *if* and *when* movement occurred, but also on *how*.

DON'T worry about judging the *how*, players can figure it out themselves as long as they get feedback.

Additional references (not in guideline)

Research on affect in games demonstrates that certain movements facilitate positive emotional effects [7, 20, 24, 46]. For example, raising your arms after a successful game action can add to the experience. However, there is still much to be explored about how variations in movement qualities affect players' enjoyment and wellbeing [22], and it is clear from designers' reports (e.g. [21, 43]) that conscious and creative variation in movement is interesting and enjoyable for players. Thus we recommend that game designers nurture players' articulation of movement to promote positive affective responses and heightened enjoyment of the movement experience.

Consider movement's cognitive load

Moving can demand a lot of mental attention, creating high 'cognitive load', especially when learning new moves. Don't overload players with too much feedback.

Developing movement skill requires not only bodily, but also cognitive attention, with is a limited resource. Initially, players need to focus on learning a new movement (so focus the feedback on this). Once they are better at the movement, they can devote more attention to more complex and nuanced forms of feedback. For example, the first time you try to pat your head and rub your belly at the same time, you probably cannot do much else, but when you get better at it, you can probably also carry on a conversation.

Example: Dance Central 3 provides multiple layers of feedback to players. Beginners can focus their limited attention on imitating the avatars. More advanced players can use the diagrams and score details to refine their moves.

Strategies for Designers

- Start by providing feedback on the movement itself, without too much worrying about scores, multipliers etc.
- Provide several forms of feedback, but do not require players to engage all of them: better to let players choose which ones to engage based on their cognitive abilities, and shift their attention as mastery grows.

DOs and DON'Ts

DO reduce cognitive complexity during movement: for example, if your player can usually remember 3 rules, as soon as she/he moves, she/he will only remember 1.

DON'T forget once players learn new movements, they may need to re-learn old ones as they integrate new skills.

Additional references (not in guideline)

Even button-press games require considerable cognitive effort, because of their interactive nature [42]. Learning new movements requires a great deal of concentration and focus, which can compete with the attention needed to parse feedback [41]. For this reason, we suggest that movement game designers take into account the additional learning and cognitive load demanded from the player when designing feedback systems.

Focus on the body

Focus on the body, not just the screen, when designing player feedback.

In movement-based games, the body is a major focus of attention: audiences enjoy watching moving bodies, and players listen to their own bodies via proprioception. Do not distract players from this focus on the body by drawing too much attention to the screen.



Figure 2: i-identity

The game i-identity (Fig. 2), in which players hold a Sony Move controller each, have to find out whose movement is sensed while moving in sync, and whose controller lights up simply at the same time, focuses on the players' bodies, not a screen (there is no screen).

Strategies for Designers

- Think past screen-based feedback. You can use audio and haptics, as well as other players to offer feedback.

DOs and DON'Ts

DO start imagining your game without a screen.
DON'T forget that for players who feel self-conscious or reluctant to move, diverting attention away from the body might be beneficial to reduce the barrier to play.

Additional references (not in guideline)

The body is at the center of the interaction in movement-based games [31], yet many current games focus on what is happening on the screen rather than the body. Some indie developers have critiqued the prevailing reliance of current game design on screen focus. Indie examples [44] help to show this is a missed opportunity to positively contribute to the play experience, for example by turning any bodily movement into a spectacle that attracts audiences [39].

GUIDELINES: MOVEMENT LEADS TO BODILY CHALLENGES

Intend fatigue

If you use fatigue as a game challenge, make it intentional rather than incidental.

Movement results in fatigue. On the one hand, it can be a welcomed challenge for players if they have to manage this fatigue (for example in endurance sports), on the other hand, fatigue can negatively affect engagement. Therefore, intend fatigue when using it as a game challenge, but avoid it when it is not part of the game.



Figure 3: Hanging off a Bar

In Hanging off a Bar (Fig. 3) fatigue is intentional: the challenge for the player is to hang onto the bar as long as possible, the only opportunities for recovery are rafts to jump onto when they pass by.

Strategies for Designers

- Minimize chances of fatigue by creating short game cycles.
- Minimize chances of fatigue by varying movements.
- Distract players from fatigue, e.g. through music.

DOs and DON'Ts

DO use the management of fatigue as a game mechanic.
DON'T assume players know how to manage fatigue, support them in figuring it out.

Additional references (not in guideline)

Research highlights that managing fatigue can be an engaging game mechanic [31]. Of course, not all movement-based games need to engage this game mechanic—for example a party game designer may avoid fatiguing players. Yet designers should remember that movement can fatigue players, and if this fatigue is not managed and is not contributing to the game, it can distract from the experience [15].

Exploit risk

Exploit physical risk sensibly.

Movement, especially in everyday indoor environments, has an inherent sense of risk associated with it: there is risk of

injury, risk of breaking furniture, risk of hitting another person. However, with risk also comes a sense of thrill, which can contribute positively to the game experience.



Figure 4: JS Joust

In JS Joust (Fig. 4), players try to jostle each other's Move Controller out of perfect level position. The risk of jostling the other player's body as well adds thrill to the experience.

Strategies for Designers

- Make players aware they are engaging in risky activity.
- Consider the environment when exploiting physical risk.
- Let players' movements interfere with each other to facilitate body contact, which has physical risk associated with it.

DOs and DON'Ts

DO put the player's safety first.

DON'T assume players will be fully aware of any emerging physical risks, as they might be distracted by engaging play.

Additional references (not in guideline)

HCI research has previously highlighted the potential for risk to positively contribute to the interactive experience [26, 31], as people might experience "feelings of thrill [arising] from a combination of fearful anticipation, followed by an extreme physical sensation, and then the euphoria of relief at having survived" [3].

Map imaginatively

Map movements in imaginative ways.

The computer allows mapping movements in many imaginative ways, in particular in ways that are not possible in real life, offering players fantasy-fuelled opportunities they do not have otherwise. Mapping does not need to be literal or slavishly true-to-life.

Wii Tennis maps every simple up-down arm movement into a successful tennis serve, fuelling the player's fantasy of being a successful and accomplished tennis player.

Strategies for Designers

- Map movement in a non-linear fashion, for example in a tennis fantasy game a weak forehand movement results in a strong hit.

- Add additional virtual movement to mapped movement.
- Engage "avateering": make the player's movements look better than they really are.

DOs and DON'Ts

DO engage your creativity in the mapping process.

DON'T use this guideline if you want to simulate a real-world sports experience, such as designing a golf simulator.

Additional references (not in guideline)

Prior research has highlighted that playing movement-based sports games is not the same as engaging in the equivalent sports activities [17]. This guideline reminds game designers that this is rightfully so, as most movement games are not intended to be highly accurate simulations of a real-world physical activity. If we only focus on simulations, we miss an opportunity to engage players' fantasy, one of the key reasons why people play digital games [27].

Highlight rhythm

Help players identify rhythm in their movements.

Movement is rhythmic: the head bobbing when dancing, footsteps when walking, even when playing tennis there is a rhythm to the arm swinging back and subsequent follow-through. Movement can be rhythmic on an individual action level (tennis swing), but also the overall movement experience often follows a rhythm of high and low-intensity actions. Movement becomes easier with a beat, so support players in identifying a rhythm to their movements.



Figure 5: Mary Mack 5000

Mary Mack 5000 (Fig. 5) is a technologically-enhanced twist on the classic schoolyard hand clapping game, highlighting the rhythm in movement through the clapping that results from players having their movement in sync.

Strategies for Designers

- Play music for players to help them identify a beat.
- Visualize previous and upcoming movements so players can identify a rhythm in their movements.
- Think of haptics not only as a feedback mechanism for action, but also as a rhythm aid.
- Use other players to help a player identify a rhythm in his/her movements.

DOs and DON'Ts

DO see movement in games not just as a string of independent actions, but as a sequence of rhythmic actions that, with a beat, get easier.

DON'T forget that engaging competitive gameplay can emerge when allowing players to try to throw their opponents off their beat.

Additional references (not in guideline)

Research has previously highlighted the key role rhythm plays when it comes to movement, for example, in sports science, the use of rhythm through music can enhance performance and enjoyment of physical activity [25]. Movement can be enriched by adding music; however, this guideline also reminds designers that movement itself often has a beat to it, and by highlighting this through appropriate feedback, the movement experience can be enhanced [34].

Support self-expression

Support players in expressing themselves using their bodies.

We communicate a lot about ourselves in how we move. Thus playing a movement-based game is always a form of self-expression, especially with other people around us. Take advantage of this to increase fun for players.

In Guitar Hero, lifting the guitar activates “rock-star mode”, motivated by the opportunity to earn more points. Guitarists lift their guitars to show off, not to play better. So building this movement into gameplay enhances a person’s ability to show off and create a spectacle.

Strategies for Designers

- Allow players to perform different kinds of movements to achieve the same outcome.
- Encourage players to try out these different movements.
- Celebrate self-expression by showing players the result of their self-expression, for example in forms of photos of their movements as trophies.
- Offer opportunities for secondary performances - movements that do not contribute directly to the goal of the game - such as lifting the guitar in Guitar Hero.

DOs and DON'Ts

DO see movement as a form of self-expression that can make your game more fun.

DON'T forget self-expression is not only concerned with the player, but also with other players and any audience.

Additional references (not in guideline)

Movement is not only a form of game input, but also supports people in their self-expression, for example the showy lifting of the guitar in Guitar Hero [7]. In particular, secondary performance or “gestural excess” [40], that is movement that does not directly contribute to the outcome of the game, can allow players to express themselves, which contributes positively to the experience [7, 21]. Good design creates opportunities for self-expression to occur through game mechanics such as the in-game reward

opportunities when lifting the guitar to “show off”. However, games that aim for specific movements, such as rehabilitation games, should probably limit support for self-expression in order to promote consistent movement.

Facilitate social fun

Facilitate social fun by making movement a social experience.

Moving with others is fun. Movement is typically visible to others and easily becomes a performance, whether we intend it or not. Therefore, design for multi-player, including other players and an audience.



Figure 6: Yamove!

Yamove! (Fig. 6) is a b-boy style dance battle game. Players compete in pairs, aiming for high intensity, in-synch, diverse dance routines. Each player wears an iOS device strapped to the forearm. The game is hosted by an MC and scoring is based on accelerometer data from the devices. Yamove illustrates that a game can facilitate social fun for players, moderators, and spectators alike.

Strategies for Designers

- If you plan to design both multi-player and single-player modes for your game, consider starting with multi-player.
- Make the game a spectacle: encourage movements that are, by nature, a spectacle others enjoy watching.
- Turn bystanders into players: allow the audience to easily join the game.
- Make the game easy to learn by observing, so that spectators figure out what is going on quickly and want to try.

DOs and DON'Ts

DO engage other players and audiences by turning the movement into a performance.

DON'T forget that movement in spaces where others do not know that there is a game going on, such as public spaces, might create socially awkward situations.

Additional references (not in guideline)

The inclusion of movement (in contrast to playing the same game with button-presses) can change the character of the

experience from playing to win to playing to socialize [28]. This is a result of the positive affect resulting from body movement [20, 28] as well as the performative character of movement that can draw audiences [39]. We found in our teaching practice that it is easier to design for multiplayer first, then single player second when it comes to movement-based games. This contrasts common game design practice, where development tools often suggest starting with single player first, as multiplayer is more difficult to implement.

FEEDBACK FROM THE EXPERTS

During the interviews, our experts expressed delight about the guidelines: *“This is great.” “This is super useful.”*

Fulfilling need

The experts confirmed that the guidelines fulfill a need that is timely: *“It’s great that someone is finally doing this.” “We would have loved that when we did [commercial title].”* They pointed out that the guidelines reminded them of their experiences when playtesting their movement-based games as part of their design processes: *“This absolutely confirmed with what we found in our playtests.”*

Usefulness for experts

Experts also commented on how some guidelines were not very useful for their own practice, as they were *“following them anyhow.”* Also, they pointed out that they follow some of the guidelines *“intuitively”* already. However, they found these guidelines still useful for teaching and supervision, to articulate design decisions and as a form of checklist (see below).

Teaching and coaching

The experts expressed that the guidelines will be useful for their teaching (all academics except the PhD students and 3 developers teach). They said the guidelines would help them structure class content and communicate key aspects of movement-based game design. Industry experts said the guidelines would be useful for them when coaching less experienced staff and supervising teams. They also said they would use the guidelines as a checklist to see if they have considered the key aspects during a design process.

Providing a language

The industry experts were especially thankful that the guidelines provided them with a language for the design choices they make during their practice, allowing them to communicate to others: *“This could have helped me when I was previously trying to argue for a design decision with the marketing department.”*

Inspirational

Our experts were particularly excited about guidelines they usually do not consider in their practice, described them as *“inspirational”*: *“I really like this ‘Intend Fatigue’, I had not thought about this one before.”* Another is *“Engage Risk”*, something industry experts had not previously

considered: *“That’s interesting that you say that this is not just something to avoid, but can be a positive thing.”*

CHANGES AFTER EXPERT FEEDBACK

The experts welcomed the guidelines. However, they also pointed out aspects to improve about individual guidelines, many of these were concerned with clarification, sentence flow or the need for additional examples. We do not go into detail about these here. However, there was more general feedback we received that helped us to refine the guidelines overall and might aid others when aiming to generate guidelines based on expert feedback.

More examples

All experts wanted more examples for each guideline, underscoring the usefulness of a portfolio of examples in presenting results of design research [13].

Open to interpretation

Initially, we tried to articulate the guidelines in a very precise manner, carefully crafting the language so that each one of them was very clear. Further precision in the language was asked for by one of the academic experts. However, all other experts welcomed language that was more open to interpretation (without being vague or ambiguous), as it allowed them to use the guideline as a suggestion that they were able to apply to their specific practice and design cases, rather than being confronted with a command to be followed.

Rules are for breaking

Seven experts pointed out that they had either themselves created or observed games in which at least one of the guidelines was not followed, yet resulted in engaging gameplay. As such, they were concerned that others might follow the guidelines too strictly. In response, we added a sentence on the front page: *“The guidelines are like rules in any creative field: of course you can also break them, but first, you need to know them before you can break them.”*

LIMITATIONS

Games-focus rather than play-focus

We focused on movement-based games, rather than movement-based play. We see games as more formal, with rules and goals [36], and play as a larger design space that encompasses games. We began with the smaller design space, but we find movement-based play a fascinating area, in particular in light of the movement-based play that emerged in the 1970’s under the term “New Game Movement” [11] that we believe holds tremendous potential when thought of in combination with digital technology.

Location-based games

The personal experience of both ourselves and our experts steered our thinking towards games played in living rooms, arts venues and conference exhibits. We note that emerging location-based games, played over large areas, are also movement-based. We acknowledge that there is not much

specific guidance for these types of games in our guidelines. However, we believe some of our guidelines (in particular Intend Fatigue, Consider Movement's Cognitive Load and Exploit Risk) are easily applicable to these location-based games, suggesting that our work might also be useful when designing these kinds of games.

Evidence of utility of guidelines

We acknowledge that it would be ideal to observe use of the guidelines in practice. Our prior work led to design guidance that supported the ideation process [33]; we believe this work may also be useful in such scenarios.

FUTURE WORK

We plan on releasing the guidelines to the public, and tracking usage based on website hits. We also plan to conduct follow-up interviews with our experts as to whether they have used the guidelines in their practice. This will help us better understand how the guidelines work in practice, and provide insights about how they need to be developed further. We anticipate the need to periodically revisit the guidelines and examples. Movement technologies continue to evolve, and canonical examples of excellent movement games continue to appear.

CONCLUSIONS

We presented a set of guidelines for movement-based game design that have emerged from our research-based game development practice. These guidelines have been examined and refined by 14 movement-based game designers with experience in academic, independent and commercial game design domains. Their positive feedback suggests that our process of engaging in design practice ourselves, analyzing and reflecting on existing games, and getting feedback from lab members and experts, can lead to practical guidelines that practitioners appreciate. The fact that the experts said they use some of the recommendations in the guidelines in their current practice and that the underlying findings match their experience suggests that we created guidelines with applicability beyond our own practice. By making the guidelines publicly available in both a paper and online format we hope we are able to reach out to both academics and practitioners, furthering the practical potential of these guidelines.

We believe our approach of directly engaging with multiple accomplished design practitioners significantly strengthened the end result in terms of both clarity and applicability. This supports the notion that researchers should not only deliver results to practitioners, but also actively engage them in the knowledge production process (e.g. [23]). Just as we as HCI researchers value and prioritize engaging end users in evaluating experiences we design, we should also value and prioritize engaging expert practitioners in the evaluation of the usefulness of the tools for design our research generates. In our particular field of game design, the boundaries between what researchers, commercial game developers and independent game

designers do are overlapping more and more, and we believe everyone can benefit from sharing work in progress and reflections about practice.

We encourage other HCI researchers to incorporate design practitioners in the development of practical guidelines in order to make conceptual thinking readily applicable to the target design community. In return, we urge practitioners to support researchers when creating these guidelines (as our experts did) in order to advance the development of knowledge. If we work together in this way, we can take better advantage of the strengths and knowledge of both communities to advance the field as a whole.

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