## A 2<sup>nd</sup> Person Social Perspective on Bodily Play

Florian 'Floyd' Mueller Zhuying Li Richard Byrne Yash Dhanpal Mehta Peter Arnold Tuomas Kari Exertion Games Lab RMIT University Melbourne, Australia {floyd, zhuying, rich, yash, peter, tuomas}@exertiongameslab.org

#### ABSTRACT

Recent HCI work on digital games highlighted the advantage for designers to take on a 1<sup>st</sup> person perspective on the human body (referring to the phenomenological "lived" body) and a 3<sup>rd</sup> person perspective (the material "fleshy" body, similar to looking in the mirror). This is useful when designing bodily play, however, we note that there is not much game design discussion on the 2<sup>nd</sup> person social perspective that highlights the unique interplay between human bodies. To guide designers interested in supporting players to experience their bodies as play, we describe how game designers can engage with the 2<sup>nd</sup> person social perspective through a set of design tactics based on four of our own play systems. With our work, we hope we can aid designers in embracing this 2<sup>nd</sup> person perspective so that more people can benefit from engaging their bodies through games and play.

## CCS CONCEPTS

• Human-centered computing  $\rightarrow$  Interaction design

#### **KEYWORDS**

Whole-body interaction; play; social; exertion games

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## **1** INTRODUCTION

Within HCI's game design community, there is an ongoing interest in the intersection between interactive technology and the human body (for example see [28, 35, 37, 38, 45, 58, 68]). This is fueled by technological advancements such as game console's motion-sensitive game controllers allowing for bodily play, wearable technologies such as activity trackers supporting sportsturned-games, and sensors in mobile phones enabling playful physical activity. However, despite these advancements, critical voices have argued that the field has not yet fully grasped a deeper understanding of the human body and how to design technology for it (for example see [19, 20, 35, 36, 38, 50, 51, 53, 55]). In particular, the critics have lamented an overly simplistic perspective on the human body [19], where players' bodies are regarded as simply alternative controllers on the same conceptual level with joysticks, keyboards and gamepads. The problem with this view is that it obscures the fact that if we talk about human bodies, we are not only talking about physical bodies, but we are also talking about living human beings.

To help game designers go beyond this simplistic perspective of the human body as a controller, we introduce a phenomenologically-inspired perspective of how human bodies interact, which we call the 2<sup>nd</sup> person perspective, complementing the 1<sup>st</sup> person "lived" perspective and the 3<sup>rd</sup> person "material" perspective (that highlights the "fleshy" body, similar to looking in the mirror) [44]. The German words "Leib" and "Körper" have been previously used to describe the body from this 1<sup>st</sup> person ("Leib", being a body) and 3<sup>rd</sup> person perspective ("Körper", having a body) [64], pointing out that human

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beings both have a body and are a body [44]. We extend this work by articulating a 2<sup>nd</sup> person perspective that highlights a social view, acknowledging that players affect each other because they both *have* a body and *are* a body. The most obvious way of how players can affect one another because they *have* a body is through body-contact (for example, one player can push another player [46]). As they are a body, they also feel a certain way about their body as well as their partner's (for example, a plaver might feel bad about having pushed another player). From psychology we can draw upon social phenomena that go beyond body-contact, such as the social facilitation effect that postulates that people perform differently when in the presence of others than when alone [4]. Here we argue that a social view can be developed from the phenomenological body perspectives. We propose that a 2<sup>nd</sup> person social perspective can be beneficial for game designers as a lens to examine how players and their bodies interact, as players never just play with another body, nor do they play with someone who just happens to be a body. Instead players always simultaneously engage with both, a person having and being a body, as they themselves always have and are a body.

We should therefore not only consider people's "fleshy" body (3<sup>rd</sup> person perspective) or how people "feel" about their body (1<sup>st</sup> person), but also how people experience other people's bodies and how they feel about them. Without a 2<sup>nd</sup> person perspective, we fall short on fully understanding social play, and miss out on design opportunities. For example, let us assume a two-player game that involves touch (like Touchomatic [40] or Sensation [8]). A 1<sup>st</sup> person perspective would put focus on how players feel about touching another person and a 3<sup>rd</sup> person perspective would focus on how players move their bodies as part of the game's touch interactions. A 2<sup>nd</sup> person perspective, however, highlights how the players can also imagine and draw upon on what the other players feel about touching and being touched.

Interestingly, these three perspectives are intertwined, for example, player A might be comfortable touching another person in public, however, player A might become aware that player B is becoming very uncomfortable touching A; this in turn has implications about how player A feels about touching. The 2<sup>nd</sup> person perspective highlights this by putting into focus that not only the Körper and Leib of one player is intertwined, but the Körper of one player is intertwined with the Leib of the other player and vice versa and that this offers design opportunities (which we will come back to in more detail). We extend prior theoretical work in this area by articulating what this  $2^{nd}$  person social perspective can mean for game design. With the aforementioned advancements in technology, we believe that the game design community now has a unique chance to develop digital games and play that not only support players to *use* their bodies to play together but rather as an opportunity to experience their bodies *as* play [44].

We make a contribution in the form of discussing the 2<sup>nd</sup> person social perspective for the game design community. We argue that this 2<sup>nd</sup> person social perspective on the human body can be a valuable design resource for bodily games that are played by more than one player. To support this claim, we examine four social bodily game systems of our own. With these systems, we articulate a set of design strategies on how designers can utilize the 2<sup>nd</sup> person perspective to facilitate engaging social play experiences. We wrote this article to aid practitioners interested in designing social bodily games as well as for researchers who aim to understand social bodily games and seek a framework to structure any analysis. Ultimately, we aim to support designers creating engaging social bodily play, so that more players profit from the many associated benefits of engaging their bodies through games and play.

## 2 RELATED WORK

Prior work has already demonstrated that when our interactions with technology involve the body to a larger extent than the traditional mouse and keyboard interactions, the result is a significantly different user experience, which can be utilized by game design [42]. To understand and exploit this phenomenon, several theoretical frameworks have emerged in the HCI literature, each of which offer different views through which the human body can be examined when designing for it. For example, Consolvo et al. suggested to design for the human body through a perspective of behavior change [9]. Similarly, Toscos et al. proposed a perspective based on goal setting theory [62] while Yim et al. [67] proposed a perspective of motivation. More experiential perspectives recently complemented these have approaches, for example Segura et al. suggested a perspective that aims to highlight the "joy of movement" [55]. Mueller et al. [50] have introduced a perspective from sports philosophy to advance the field. Furthermore, Loke et al. [32] and Shiphorst et al. [64] suggested that a perspective of dance could be beneficial as dancers have a long history of engaging deeply with the human body. These works highlight seeing the human body from more than one perspective can have benefits for design.

When it comes to the human body and game design, Mueller et al. proposed a set of themes such as "rhythm" and "risk" that designers should consider when designing bodily games [45]. Similarly, Isbister et al. [27] and Mueller at el. [48] proposed design patterns in order to aid designers with practical recommendations for bodily games. These works have arguably brought the field forward, however, several academics have lamented that our understanding of how to design for the human body is still underdeveloped. Purpura et al. finds that current body-based designs are almost exclusively treating the human body as an object that falls ill and can only be saved from dying thanks to technology [51]. Similarly, Linehan et al. critiqued the field from a game design perspective and provocatively titled their argument "Games Against Health" [31], suggesting that games that see the player's body only as a health-intervention opportunity will not be enjoyed. Similarly, Marshall et al. [38] critiqued the field for missing out on all the other perspectives through which the human body could be examined. Tholander et al. [60] proposed as an alternative a dualistic perspective: designers should consider both an instrumental and experiential perspective when designing for a particular bodily experience. Our paper extends these works by drawing from phenomenology to articulate how designers can engage with a social perspective, focusing on the interactions between bodies rather than on an individual's experience as in prior work.

We also note that highlighting the value of phenomenological thinking to the design of interactive systems is not new in HCI. Dourish [12] has with his book "Embodied Interaction" brought interaction designers closer to this worldview. Works by scholars such as Djajadiningrat et al. [11] and Hornecker et al. [21] have then tried to make this worldview more accessible to interaction designers, which both Dourish and Winograd acknowledge is not easy due to the abstract nature of phenomenology [12, 66].

Svanaes has examined phenomenology's view on the human body from an HCI perspective [59]. He discussed in particular Merleau-Ponty's phenomenological perspective on the human body [41], proposing that using this perspective might result in "new design alternatives", assuming that "more design alternatives to choose from is in most cases a good thing" [59]. Similarly, Höök et al. [20] lamented the limited understanding of the field as evident by a dominant "instrumental view" on the human body in existing designs. She calls for an alternative perspective that aims to highlight the "pulsating, live, felt body" [20]. Our work is very much inspired by these works and aims to further contribute towards answering such calls for extended knowledge on body-perspectives that is readily applicable for design practice.

Isbister [22] argued that social play is fundamentally different from single-user play and proposed that we need specific design knowledge for multiplayer games. To facilitate the development of such knowledge, Mueller et al.'s social perspective [45] can be seen as a response to this: the authors propose the notion of "relating body" that describes how bodies relate to one another (inspired by van Manen's "Relationality" [33] that is an important dimension of the lived experience) in order to sensitize designers to a specific social perspective. Mueller and Isbister brought their expertise together [27] to develop a set of movement-based game guidelines, one of which stresses the opportunity to "facilitate social fun": the authors argue that the highly visible body movements can entice bystanders to join the game. Here we extend this work by providing a perspective beyond bystanders through which designers can examine social bodily play.

Mueller et al. [50] introduced a perspective of human values from sports philosophy to advance the field of bodily play, however, they mostly focus on solo exercise experiences. Similarly, Wilde et al. [64] and Loke et al. [32] proposed a dance-inspired perspective, and although their systems are used by multiple dancers they are often not considering social bodily experiences, such as when one dancer lifts another. Seif El-Nasr et al. have highlighted unique patterns in social games [56] while Mueller et al. [46] have explored bodily interactions that occur between people, such as when dancing together, and have in consequence proposed a perspective of bodily interplay. Our work builds on this and presents an orthogonal perspective to the bodily interplay dimension. Segura et al.'s work on the "joy of movement" depicts social play scenarios [55] to support co-located bodily play [54], similar to the work by Wilson [65], while Isbister et al. highlight the potential of wearables to facilitate this [25]. Marshall et al. [38] suggested that we need to see the human body from more than one perspective. This was extended by Mueller et al. [44] who suggested the phenomenological terms of "Körper" and "Leib" as a way to tackle different perspectives on the human body in game design. Our article extends this prior thinking by elaborating on the  $2^{nd}$  person perspective that complements the prior  $1^{st}$  person and  $3^{rd}$  person perspectives that the Leib and Körper notions depict. In particular, we use the 2<sup>nd</sup> perspective to highlight the potential for game designers to engage with an experiential understanding of social bodily play experiences. As such, the 2<sup>nd</sup> perspective helps us to sharpen our focus on how to support player's experiential understandings of the Leib experience of *other* players. We acknowledge that although prior work has not often used the "2<sup>nd</sup> person" wording, it often dealt with similar design considerations, for examples we refer to discussions around ethnomethodology's role of the body in social interaction [10]. Furthermore, others, like Tomico et al., also used 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> person perspectives in design, but they do not refer to a phenomenological perspective [61].

To summarize, prior work revealed that when it comes to the human body and technology, particularly in regards to game design, the field has not yet fully considered that there are multiple perspectives from which one can see the human body, and as such, there is limited knowledge on how to engage with it from design practice. This limits the games being developed and hence the growth of the field, and in consequence, the games people play, which in turn limits people profiting from the many benefits of engaging the human body through games and play [50]. To address this gap, we discuss a social perspective through which designers can examine human bodies during gameplay. This perspective aims to complement existing perspectives, hopefully resulting in additional design alternatives. By complementing the 1<sup>st</sup> and 3<sup>rd</sup> with a 2<sup>nd</sup> social perspective, we see an opportunity to develop a design vocabulary that expands a single view on the body by means of the two terms "Körper" and "Leib" in terms of social play design. This extends prior work by not only examining "fleshy" bodies (Körper) interacting, but also how each player "feels" about their own and their partner's body (Leib) during play. The result is a more detailed picture of how to design bodily games and play.

## 3 EXAMPLE PLAY SYSTEMS

We now investigate several existing games and play systems that exemplify our thinking. While "Balance Ninja", the "Guts Game", "Arm-A-Dine", and "You Better Eat to Survive!" (YBEtS!) are our own work, we also refer to systems by others. We aimed to select a diverse range of systems with different technologies, approaches and objectives. Our goal was to represent a wide, yet practical range of technologies that aim to facilitate different types of social play experiences. For example, the Guts Game facilitates a more intimate social play experience, while YBEtS! can be an engaging social experience for audiences. Furthermore, these play systems represent a wide range of expertise we have relative to the social play they facilitate. For example, the Guts Game is more experiential and does not lend itself to large social play experiences, in part because the required pill cost approximately \$100 and game duration is usually 24-36 hours. In comparison, YBEtS! has been "road-tested" worldwide and widely exhibited, it also won the CHI Student Game Competition Award 2017.

Based on our experiences of designing, playing, exhibiting and reflecting on these games, we articulate a set of strategies on how designers can utilize the 2<sup>nd</sup> person social perspective illustrated with our examples. The strategies have emerged through an iterative process in which thinking about the aforementioned concepts has also influenced our design practice in return. This process has been previously used successfully to develop a framework about sensing movement [2], proxemics play [49], and bodily play [44]. By engaging with such a process, we believe we are able to paint a vivid picture that is abstract in nature yet close to design practice.



Figure 1. Balance Ninja – a social balance game using galvanic vestibular stimulation

## 3.1 Balance Ninja

Balance Ninja [6] is a two-player digital game that aims to facilitate an engaging vertigo experience [7]. In Balance Ninja, players must battle to keep their balance whilst under Galvanic Vestibular Stimulation (GVS) triggered by an opposing player (fig. 1).

Both players stand on their own wooden board that rests on a beam. They both wear a GVS system, a safe way

of affecting one's balance by applying a small current (+/-2.5mA) to one's vestibular system. Electrodes placed behind each ear deliver the current and the user feels a pull towards the anode and also feels a loss of balance in that direction. Players also wear a tight-fitting pouch attached to their chest containing a mobile phone and the accelerometer readings taken from the phone affect the other player's GVS system. For example, if player 1 leans to the left, the GVS of player 2 creates a pull to the right for player 2 (and vice versa). The more player 1 leans, the greater is the level of stimulation applied to player 2.

The objective of the game is to cause the opposing player to lose his/her balance and either step off the board or touch the board to the floor. Players are free to "attack" at any time. A point is awarded to the winner of the round and the first player to reach five points wins the game.

Examining Balance Ninja from a 2<sup>nd</sup> person social perspective highlights the following: Players experience a sensation of vertigo as a result of digital means, however, this sensation is triggered by another person. Sensations are localized [57], here, this localization comes from another person (like someone else touching you), however, the "strange" and intriguing experience comes from the fact that this sensation is delivered wirelessly over the local network, without participants touching each other (i.e. pushing you so you lose your balance).



Figure 2. The Guts Game – a social temperature game using ingestible sensors.

## 3.2 Guts Game

The Guts Game is a two-player mobile game, centered around a set of game goals that require players to change their body temperature that is measured with an ingestible sensor (Fig. 2) [5, 30, 70]. It is a pill-like device, which when swallowed, wirelessly transmits body temperature data as it travels through the digestive tract for approximately 24-36 hours. On players' mobile phones the target body temperature is represented by the height of a frying pan above a fire. The animated flame represents the player's current temperature. There are several tasks the players are faced with throughout the day, and upon completion of the task, the player receives points. The goal of each task is to change the body temperature to move the top of the flame as close as possible to the frying pan. The game supports social interaction: the two players can challenge each other using photos and text and also exchange strategies they employed to reach shared challenges.



Figure 3. Arm-A-Dine participants feeding each other using on-body robotic arms.

#### 3.3 Arm-A-Dine

Arm-A-Dine is a two-player interactive playful eating experience (Fig. 3) [71]. Each participant wears a robotic arm, attached to a vest, turning it into a third arm used for eating and feeding others. The scenario is a casual eating experience while standing up, as often experienced in conference settings such as at CHI. As the robotic arm is attached to the body via a vest, participants need to move their bodies in order to align the arm's gripper with the food on the table when picking it up (allowing the selection of certain foods by moving slightly around) and when presenting it to their eating partner. Once the robotic third arm picks up a particular food item, it feeds the food item either to the wearer or to the partner, depending upon whether the system senses (through a mobile camera attached to the vest) the partner making a more negative (for example, if the partner did not enjoy the previous food item) or more positive facial expression (for example, as a result of having enjoyed the food or the interactions with the partner). If the system senses neither a particularly positive or negative emotional response, the robotic third arm makes ambiguous movements in mid-air as if to tease both participants with not revealing who will be fed next before making a random choice.

Arm-A-Dine was designed to explore playful eating interactions by focusing on the feeding action from the plate to the mouth while considering the strong affinity eating has with affect and emotions. An associated study demonstrated that Arm-A-Dine can facilitate social interactions, promote bodily engagement and generate a lot of laughter.



Figure 4. The non-VR player feeds food to the VR player as he cannot see the food.

## 3.4 You Better Eat to Survive!

"You Better Eat to Survive!" (YBEtS!) [2] is a twoplayer virtual reality (VR) game involving food (Fig. 4). One player puts on a VR headset and tries to find a way to call for help after being stranded on a virtual island. The game uses the narrative of a survival adventure game, where the main character has not eaten for days and is on the brink of passing out, thereby constantly losing vision in the game. We refer to the loss of vision as blackout phases and represent them using a steadily shrinking view (Fig. 3). The blackout phases are activated throughout the game. The objective of the VR game is to move around the island and find different objects via gaze interaction, which ultimately leads to uncovering a flare gun that is hidden on the island. Once found, the player fires it to call for help and wins the game. If a blackout phase starts, the only way to regain vision (and therefore continue looking for clues) is by eating real food. The eating activity is detected using a microphone attached to the player's cheek.

Auditory feedback (digital chewing noises) and visual feedback (virtual crumbs in the VR world) are used to

portray the chewing activity in the game. With every chew, the player's view gets increasingly restored until there is full vision again (fig. 5). In case not enough food was eaten or there is no food left, the player loses the game.



Figure 5. Transition of vision during a blackout phase.

A key challenge for the VR player is that he/she does not see the food because he/she is wearing the headmounted display (Fig. 4). The food is prepared and rationed on three tables set up in a triangle around the players, resembling a playing field. The job of the second player is to lead the VR player around the playing field and guide him/her to the food and then feed him/her. This creates a setup of two players playing the same game, but one in the virtual and the other in the physical world. This setting is enforced by requiring the players to play as one "shared body across both worlds": the VR player cannot see the food but sees the virtual world, while the other player does not see the virtual world but sees the food. Physically, the players resemble one body because the physical world player embraces the VR player from behind and uses his/her own hands as it would be the VR player's hands to feed him/her, while the VR player is not allowed to use his/her hands. In order to win, the players need to cooperate: While the VR player tries to discover a way to get help in the game, the physical world player is in charge of feeding his/her companion to prevent him/her from losing vision in the game. To this end, the game aims to facilitate a rich social experience around eating and VR.

## 4 DESIGN STRATEGIES

In order to offer designers an understanding of how they can utilize our theoretical thinking, we now describe a set of strategies identified from the games and play systems described above. These strategies aim to highlight the potential of using the  $2^{nd}$  person social perspective as a rich design resource when aiming to create social bodily play experiences.

Our approach to developing these strategies was guided by research through design [13, 69] and the notion of portfolios [16, 17]. We acknowledge that each play system did not contribute to the strategies to the same extent. We identified the strategies based on our personal assessment of how significant they were in the success of the designs as well as how useful and non-obvious they might be for game designers. The selection is inherently biased but as a result hopefully interesting to practitioners. The identified strategies represent only a first attempt towards understanding the 2<sup>nd</sup> person social perspective in game design and it should be regarded as inspiration for future research rather than a final articulation of design guidelines. Further work is needed to articulate a more comprehensive list. However, we believe that our work lays a foundation through a structured approach towards utilizing the 2<sup>nd</sup> person social perspective to facilitate engaging bodily play experiences.

# 4.1 Strategy 1: Use malleability of bodies' boundaries to intertwine them

This strategy is concerned with the extent to which the play system uses the malleability of our bodies' "boundaries" to intertwine multiple bodies. The children's game "the 3-legged race" operates as a useful example. In this game, two children stand hip to hip and use a string to tie together the inside ankles of their right and left leg respectively. They then run a race, competing against other pairs. Initially, they will start walking slowly and awkwardly, falling over and tripping, but quickly their bodies' malleable boundaries are "merging" into one "shared" third leg and the players are able to run as one body.

Slatman highlights [57] how our bodies have boundaries, however, these boundaries are malleable: an example is a walking stick of a vision-impaired person. Initially, the stick will be an external tool, but after a while of use, the person's body boundary includes the stick. Similarly, a person wearing a hat can (after wearing the hat for a while) gracefully enter a low walkway without much conscious effort. As such, a body's boundary is malleable. We highlight to designers that there is an opportunity to draw on this malleability in order to intertwine bodies in novel and intriguing ways. Therefore, this strategy makes us aware of the difference between a 1<sup>st</sup> and 2<sup>nd</sup> person perspective by deliberately conflating them. The intertwining can contribute positively to engagement, as it facilitates initially a loss of bodily control, and with learning (as in our 3-legged race example) players regain some bodily control; this losing and regaining of bodily control has been previously highlighted as a useful tactic to facilitate engaging play experiences [39] and we also found that participants seemed to enjoy it with our play systems as indicated by a lot of laughter. As such, we recommend to designers to use the malleability of bodies' boundaries to intertwine the players' bodies in order to facilitate engaging social play experiences.

Balance Ninja reminds us of traditional balancing games where players face each other trying to balance on a small plank. In order to make it more challenging, the players are often equipped with props such as a broom or toy sword that allows them to disturb the balance of the other player. However, this bodily action often causes the player him/herself to fall. In Balance Ninja, players do not have such a "shared object" [46] that becomes part of their body through the malleability of their bodies, however, the networked system that connects bodily movement with GVS control functions as such: a player's body boundary is extended through the chest-mounted mobile phone to the vestibular sense of the other player, intertwining the players' bodies in a playful way. This is facilitated, we believe, through the technology being so close to the human body: the mobile phone is attached to the players' chest via a stretchy cord, allowing for the detection of fine movements. Our system is safe as it uses a conventional phone, however, designers might need to think about safety when it comes to technology using the body's malleability, such as when an electric current is very close to the body.

The Guts Game plays with the malleability of the body's boundary through the ingestion of the pill and the resulting data being transmitted to the other player: before swallowing it, the pill is separate to the human body, however, once swallowed, it becomes part of the body and players cannot separate from it until excretion. The data arising from the body, i.e. the temperature data, is then shared with another player, intertwining the two bodies involved. Again, like in Balance Ninja, the closeness of the technology appeared to facilitate this engagement with the malleability of the bodies' boundaries: the fact that technology can be ingested allows for novel ways to intertwine bodies through their malleability. In both cases, the closeness between technology and body raises questions about safety that designers need to be aware of.

In Arm-A-Dine, the mounting of the robotic arm on the player's body (instead of, for example, on the table)

engaged with the malleability of players' bodies: it was easy to see how even after only a short while using the system, the participants considered the robotic arm as their third arm and used it to complement their embodied eating action as a whole. As this robotic third arm was then proposing to feed the eating partner, it facilitated an intertwining with the other person, including his/her own robotic arm. This intertwining often resulted in a playful interference of the two bodies involved, such as when participants ended up trying to feed food into each other's mouths at the same time, resulting in a lot of enjoyment.

In YBEtS!, the rule that the non-VR player had to move his/her hands underneath the other player's arms from behind engaged with the malleability of bodies: similar to the 3-legged race, the two bodies become, with practice, "one" body, where the non-VR person is leading the VRperson (as she/he cannot see the physical environment). The VR person has to trust the non-VR person in order to achieve the objective of the game, which probably further facilitates the two bodies becoming intertwined. So YBEtS! highlights that intertwining of bodies can be facilitated also through rules about what players are allowed to (and not allowed to) do with their bodies.

Within the literature, we find further examples in which malleable bodies have been brought in to some extent. For example, the game "Sensation" [8] engages with malleability as players need to touch one another's hands to perform certain gestures together. Through looking at our strategy, it is possible to suggest a more radical version where player pairs, who are already holding hands, need to additionally touch bystanders with their intertwined hands in order to also engage an audience. Similarly, the strategy could inspire a new level in "Bounden" [15], where the system would facilitate intertwining bodies by introducing another mobile phone that needs to be held together at the same time. Non-game example systems could also profit from our work, for example, work on exoskeletons could benefit from our strategy if their designers are interested in supporting social bonding between wearers and would like to facilitate this through playful means. We also point out that our strategy 1 sits within the "culture" theme of the work by Marshall and Tennent [40], which highlights cultural implications of body contact and how culture affects how people feel about such body contact in games.

## 4.2 Strategy 2: Support bodily mimicry

This strategy is concerned with the extent to which a play system supports players in engaging with bodily

mimicry in order to facilitate an engaging social play experience. Barsalou et al. already articulated how perceiving bodily states in other human beings produces bodily mimicry [1]. For example, if a person scratches his/her nose during a conversation, then the person sitting opposite to him/her is also likely to do the same. This is important for game designers to consider because we know that if two people smile in response to a playful event, it can facilitate each other's expressiveness and consequently affect their emotional experience [29]. Furthermore, if a player perceives facial expressions of emotions, it activates this player's facial muscles that correspond to the perceived emotion (in [29]). It has also been suggested that mimicking serves a social function, for example, people like each other more if they mimic each other and mutual liking can foster relationships between people [1]. In other words, because the other player also smiles, the player's enjoyment is increased [18]; this realization is slowly getting attention in game design [24, 26, 54]. Although we did not empirically measure smiles with our play systems (which we could easily do using the "smile" sensing capability of Arm-A-Dine), we can offer anecdotal evidence that a player's smile was "contagious": as soon as one player started smiling, the other often chimed in.

Bodily mimicry can widely happen in play experiences of board games, however, we point to digital games which are designed to be played on the living room's TV, where the position of the screen demands players' orientation facing forward, away from each other. This is cemented further by sensing technologies such as camera-based skeleton tracking (as made popular by the Microsoft Kinect) that works best if the players are facing the same direction, rather than facing each other. Such setups hinder opportunities for perceiving bodily states and hence opportunities for bodily mimicry (which innovative research games have aimed to address, for examples see [23, 24, 26]).

Balance Ninja supports bodily mimicry, as the physical setup of the game (two balance boards opposite each other) positions the players so that they face each other. There is no screen (besides the screen that shows the score after each round) that might draw the player's visual attention away from the other player. Players must closely observe their game partner, as they cannot perceive any game state except through looking at the other player, in particular when the player is beginning to lose control of his/her balance (that is visible to the other player through facial expressions and the flailing of arms and legs). As such, the game aims to support a player's experiential understanding of the other player's bodily experience by allowing them to experience the other player's off-balance through their vestibular sense. A player's balance is the result of the visual, proprioceptive and vestibular system working together, here, a loss of balance is made visible to the other player (supporting mimicry) and then further stimulated through the use of the GVS system.

In the Guts Game, players are in the same room when the game starts, where they take the pill and listen to a narrative that frames the gameplay (about a parasite in the player's body that is affected by body temperature), hence they have opportunities to engage with bodily mimicry. Once the two players go their separate ways, the ability to share pictures with one another (such as when they achieved certain game tasks) is an opportunity to engage in bodily mimicry: participants indeed shared pictures of themselves with various facial expressions (depending on whether they achieved their tasks). We propose that in addition to pictures, including a videoconferencing ability might have supported bodily mimicry even more.

Arm-A-Dine supports bodily mimicry as the two diners are facing each other across the table. The video camera that senses affective responses further contributes to the bodily mimicry component, as the interviews suggested: participants said that as they were aware that the camera was looking for either positive or negative expressions, they were sometimes exaggerating their facial expressions in order to increase the chances for the detection software to identify the correct expression. As such, participants' perception that the camera sensing software will have limitations and will work best on obvious, strong facial expressions, led them to exaggerate their facial expressions, which would make them also more visible to their partner, supporting the emergence of bodily mimicry to occur.

YBEtS! does not engage with this strategy very much as players are not facing each other and one of the two players cannot even see the other player due to the headset. However, we can use the strategy to envision a future version of the play system: for example, YBEtS! could engage with mimicry by having a camera sense the player's facial expressions and movements. This could be a source for mimicry that could then be communicated to an audience. This audience could then engage in mimicry themselves, even when players are facing away, or use this information to direct the VR player's next move. We can use this strategy to ideate a new version of the game "Remote Impact" [43, 47], a networked shadowboxing game for players in distributed locations. Cameras behind the players capture their silhouettes and project that shadow onto the remote location. This supports bodily mimicry in terms of gross-motor movement, but not in terms of facial expressions, for this, an extended future version could also employ face-tracking cameras that would overlay facial expressions onto the projected shadowboxers.

## 4.3 Strategy 3: Connect one player's movement with another player's sensation

This strategy is concerned with the extent to which the system connects one player's movement with another player's sensation. Movement facilitates certain sensations, for example if a player runs, she/he will start sweating. Here we point to the opportunity of technology to connect one player's movements with another player's (so not their own) sensation. As mentioned, the Körper and Leib terms allow for seeing the body from two perspectives: from a material perspective and a lived perspective. Thus this strategy is concerned with the technology that facilitates linking one player's Körper with another player's Leib.

Prior work has highlighted that game design has so far mostly focused on vision, but there is an underexplored opportunity to also engage the other senses in order to support the human body as play, such as touch and taste [44]. Here, we highlight to designers the opportunity to use sensed movement and connect it with sensations beyond vision, such as the sensation of taste. We note that not all sensations lead to experiences traditionally considered positive, but refer to Benford et al.'s work [3] that stressed that even uncomfortable interactions can be valuable as they can entertain, enlighten and contribute to sociality. We observed such interactions particularly in regards to unusual behavior in a social setting as a result of connecting movement with sensation, which resulted in enjoyment. For example, an Arm-A-Dine participant reported: "I was trying to focus on my face and the food but this made me burst out in laughter."

We acknowledge that this strategy can be seen as extending the theme "physical awareness" in the work on bodily play [37] by not only considering injury (a Körper perspective) but also how players feel about it (Leib perspective).

In Balance Ninja, one player's movement (here: the leaning) affected the other player's GVS and as such the

potential to experience a vertigo sensation. Being able to affect another person's sensation of vertigo through moving one's own body appeared to be the source of great amazement and resulted in a lot of laughter. So, one way for designers to connect one player's movement with another player's sensation is by using wireless networks as with the local Wifi network between Balance Ninja players.

This reminds us of the well-known phenomenon that one cannot tickle oneself, however, tickling another person - as well as being tickled - can be a very playful social experience. The reason why we cannot tickle ourselves is because two brain regions are involved in processing how tickling feels. The somatosensory cortex processes touch and the anterior cingulate cortex processes pleasant information. Both these regions are less active during self-tickling compared to during tickling performed by someone else, which explains why it does not feel tickly when you tickle yourself. The interesting thing here is that the cerebellum can predict sensations when your own movement causes them but not when someone else does. When you try to tickle yourself, the cerebellum predicts the sensation and this prediction is used to cancel the response of other brain areas to the tickle.

This aligns with the designers' experiences during developing the Balance Ninja's GVS system: the effect was initially experimented with while sitting on a Swiss exercise ball, and when the GVS was applied, one would lean to the side until tumbling off the ball. Interestingly, if the same person sitting on the ball would trigger his/her own GVS command (by pressing a button on an earlier version of the system), the effect would not be as exaggerated as when another person pressed the button. The effect was even greater when the button was on a long cable and put out of view. With Balance Ninja, the players were engaged through trying to predict when the GVS will occur by trying to "read" the movements of the other player. Therefore, we argue that networking technologies (such as the wireless connection between the Balance Ninja players) offer a unique opportunity for game designers to connect movements of one player with sensations of another.

In the Guts Game, players reported that they tried out various physical activities in order to raise their body temperature. They saw the result through the flame. If they were challenging each other, they also saw the result of the other player's movements (i.e. the temperature) through the mobile phone interface, as such, they had access to their co-player's body temperature through the cellular network between the two mobile phones. Although the system did not directly provide a sensation as a result of the transmitted temperature information, we can say that the inclusion of the chat channel and the ability to send photographs aimed to facilitate connecting the movement activity with certain sensations and resulting feelings: for example, participants sent selfies of them being happy or disappointed if they managed to reach or not reach a certain target temperature. As such, we can say that one player's movement was (at least loosely) connected to another player's sensation. In future versions of the system, we can envision engaging other modalities such as haptic feedback in order to connect movement with sensations.

In Arm-A-Dine, a person's affective response to eating a particular food item (especially when eating something they do not like) was linked to movement: here, it was the movement of the robotic third arm. The chest-mounted camera detected if people had a particular sensation as a result of eating a particular food item (such as scrunching one's face), which was detected by the camera, and then resulted in a particular arm movement to either feed one or the other diner. In consequence, participants also moved, as they were trying to grab the food of the gripper. As such, we highlight to designers who aim to connect movement with sensation that they can also connect sensations with an actuation device that moves.

In YBEtS!, the movement of the non-VR player was connected to the sensation of the VR player: the non-VR player was moving around the space to guide the VR player to the various food plates positioned around the room. So the movement of the non-VR player resulted in the feeding of the VR player, which resulted in certain eating sensations, such as when enjoying pleasant food items. As such, YBEtS! highlights for us that the connection between movement and sensation does not need to be technologically mediated but can also be achieved through spatial means. Here it was the spatial layout of the play space combined with the rule that the non-VR player needs to stand behind the VR player.

So far, we have mostly used fruits with YBEtS! but could envision the use of hot food that emits stronger smells. This could promote a tighter connection between a player's movements and the other player's sensation in that, as the non-VR player moves around, the VR player would smell the location of the food, which could be used to help navigate the space. Similar to the Guts Game, the Heatcraft system [72] also uses ingestible sensors but connects the sensor data from the ingestible sensor to a heat sensation delivered via a heating pad worn around the person's waist. Participants who played in pairs reported that they enjoyed trying out each other's waist belts, and we can use this strategy to envision future versions where one person's movements resulted in an increase in temperature that the other person can experience through a heat sensation on their waist. This could be useful, for example, to facilitate a sense of connectedness between long-distance couples.

## 4.4 Strategy 4: Design for Player's Körper as well as Leib when performing in front of others

This strategy is concerned with the extent to which the system considers both the Körper and Leib of the players performing in front of others. Some games are deliberately played in front of an audience as the game lives on the crowd's appreciation (e.g. Johann Sebastian Joust [14]), while others are indifferent to audiences (like most console games), yet players often enjoy playing them while others are around [63]. If players engage in gameplay in front of others, designers should consider this in their design. Here, we extend prior work on playing in front of audiences [52] by highlighting that if the human body is more physically involved (such as in bodily play), any such movement is more visible to others (compared to mouse and keyboard play), which goes hand in hand with how people *feel* about this increased visibility; designers should consider this in their work. Prior work has already touched upon this, for example, the authors of the "Touchomatic" work [40] highlight how supporting players in intimate social play needs to involve the consideration of how players feel playing in front of an audience.

In Balance Ninja, the players' Körper were designed for in terms of the playing area being free of any obstacles, so that players could not hurt themselves when stumbling as a result of the gameplay. The Leib perspective highlights how players feel when playing in front of an audience. On the one hand, bystanders could not see why players would find it so difficult to balance on the balance board, as it, from the outside, looks like an easy task. As such, players might be feeling embarrassed about their performance. The wires coming from behind their ears might suggest to bystanders who know about GVS what the reason for their stumbling is, and the screen that shows the score might further reveal that a digital game is in progress. To further support this, a future iteration of the system could include a digital signal indicator (such as a bright LED) that could make it visible for audiences when leaning is detected and when GVS is fired.

Guts Game players were informed through a consent form that they had to be careful if they decided to do any physical activity in order to raise their body temperature, as such, they were aware that they needed to look after their own and any bystanders' Körper. Afterwards, during the interviews, participants did not report any injuries, however, they talked about feeling embarrassed when doing physical activity in front of other people. This was exacerbated by the fact that the challenge they received from their co-player arrived at a time when they were in a location where physical activity was not common, such as at work. In future versions of the system, game designers could alleviate this by sensing contextual information (such as GPS coordinates to determine when people are at work) in order to allow for challenges to occur only in suitable locations.

The Körper of Arm-A-Dine participants and their audiences were considered in terms of selecting a robotic third arm that can only do slow movements and does not have much power, so chances for injury were very low in the case of malfunctioning. From a Leib perspective, participants reported that they felt strange when Arm-A-Dine was tried out in a public restaurant. The noise of the robotic third arm attracted attention, involving even those who could not see the system. How to address this is an ongoing area for future work that could also have implications for the development of prosthesis and their acceptance in regards to being used in public.

In YBEtS!, the Körper of the players were kept safe by designing a virtual island in VR that the player could not leave, keeping his/her reach limited, which prevented him/her walking into furniture as well as any bystanders. The use of another player that embraced him/her further emphasized this safety feature. However, playing a VR game in front of others always comes with the risk that the VR player does not know if the audience laughs at him/her, especially when seemingly having trouble performing simple tasks such as eating. The VR headset prevents the player from seeing any bystanders, and the use of headphones that play sounds from the virtual island further prevents the player from feeling embarrassed by not knowing how the audience reacts.

Combat games like Remote Impact [43, 47] can in particular benefit from this strategy, as their full-body involvement makes for a great spectacle for participants in terms of the Körper. The Leib could also be considered here, for example, by providing insights to the audience on how the players *feel* about hitting another person, even if it is only a virtual representation. Eliciting insights into this Leib perspective is not easy, especially in such fastpaced games, where extracting verbal responses is not very practical. However, we believe that the use of biosensors will become more prevalent to support this and we therefore point to this as an interesting area for future work.

## 5 LIMITATIONS

We acknowledge that our work has limitations, as does all design work. In particular, we acknowledge that our work has only scratched the surface of the 2<sup>nd</sup> person social perspective and game design. There is more to explore and further investigations into the social body and play will provide fuel for future work. Additional work might also investigate how this 2<sup>nd</sup> person social perspective can inform future design methods, such as how designers can bodily interact with one another as ideation method, which could lead to a "social bodystorming" as an extension to the bodystorming work [34], for example. We have also not yet discussed human bodies that are beyond a culturally understood "norm", such as people with injuries or disabilities. We believe our work can also contribute to such investigations as it highlights to look at the interplay between bodies rather than at their differences, advancing an ethical discourse on the human body in games.

## 6 CONCLUSION

Interaction design and, in particular, game design has an ongoing interest in the coming together between interactive technology and the human body, fueled by technological advancements. Yet, recent scholarly work suggests that the field has only just begun to fully understand the various perspectives through which designers can see the human body. To further the field, we introduced the 2<sup>nd</sup> person perspective as a social view to complement the previously articulated 1<sup>st</sup> ("lived") and 3<sup>rd</sup> ("fleshy") perspectives on the human body and articulated implications for design. We discussed this perspective by looking at a set of bodily game and play systems from our own work and reflected also on other people's work.

We see our present work as a starting point towards complementing existing perspectives on the human body by highlighting the unique inter-body phenomena that With our work, we aim to contribute to the emerging intersection between the human body and interactive games and play. We believe that for a successful combination of technology and the human body, we need to move beyond seeing the human body as just an alternative input device and recognize that we do not only *have* a body but also *are* a body and that this body is shaping and is shaped by social processes. Through this, we believe it would be possible to not only play *with* our bodies but experience them *as* play. We hope with our work we are able to support designers with a starting point for better play design, aiding in facilitating the many benefits of engaging the human body through games and play.

In summary, we believe that for a successful combination of technology and the human body, we need to move beyond seeing the human body as solely a "thing", and instead need to embrace that we both *have* a body and *are* a body and that the same applies to the people around us. If we do so, we believe it is possible to experience our bodies as play. We hope with our work we are able to support designers with a starting point for better designs, aiding in facilitating the many benefits of engaging the human body through games and play, ultimately contributing to a more humanized technological future.

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