“Erfahrung & Erlebnis”: Understanding the Bodily Play Experience through German Lexicon

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ABSTRACT

Bodily play systems are becoming increasingly prevalent, with research aiming to understand the associated player experience. We argue that a more nuanced lexicon describing “bodily play experience” can be beneficial to drive the field forward. We provide game designers with two German words to communicate two different aspects of experience: “Erfahrung”, referring to experience where one is actively engaged in and gains knowledge from; and “Erlebnis”, referring to a tacit experience often translated as “lived experience”. We use these words to articulate a suite of design strategies for bodily play experiences by referring to past design work. We conclude by discussing these two aspects of experience in conjunction with two previously established perspectives on the human body. We believe this more nuanced lexicon can provide a clearer understanding for designers about bodily play allowing them to guide players in gaining the many benefits from such experiences.

CCS CONCEPTS

• Human-centered computing → Interaction design

KEYWORDS

Whole-body interaction; bodily play; exertion games; play; games

ACM Reference format:

Florian ‘Floyd’ Mueller, Louise Matjeka, Yan Wang, Josh Andres, Zhuying Li, Jonathan Marquez, Bob Jarvis, Sebastiaan Pijnappel, Rakesh Patibanda, Rohit Ashok Khot. 2020. “Erfahrung & Erlebnis”: Understanding the Bodily Play Experience through German Lexicon. In *Proceedings of the ACM Tangible, Embedded, & Embodied Interaction conference (TEI’20), February 9–12, 2020, Sydney, NSW, Australia.* ACM, New York, NY, USA. 12 pages. https://doi.org/10.1145/3374920.3374926

TEI ’20, February 9–12, 2020, Sydney, NSW, Australia
 ACM 978-1-4503-6107-1/20/02...$15.00
https://doi.org/10.1145/3374920.3374926

1 Introduction

The game design community within HCI has demonstrated an increasing interest in bodily play experiences (e.g. [1, 5, 30, 36, 37, 39, 40, 46-48, 50, 52, 55, 68, 76]), facilitated through technological advancements. Examples include locomotion-sensing cameras, movement-aware controllers, wearables that track bodily activity, virtual and augmented reality headsets that support bodily movement and motion-sensitive smartphones. However, despite recent efforts in developing frameworks for bodily play experiences (e.g. [24, 45, 49]), many researchers feel that the conceptual construct surrounding the design of bodily play experiences remains underdeveloped [19, 20, 36, 38, 40, 53, 54, 60, 63, 64]. In this paper, we aim to clarify the concept of bodily play experience by examining that we gain *experience through our bodily play* and we also *experience our body through play*. With this article, we discuss what this means for HCI designers.

We propose that a more nuanced lexicon about “bodily play experience” can open up new ways of discussing and describing the phenomenon, benefiting its design. To facilitate this, we use two German words that describe experience. Such an approach has been previously used in HCI to discuss general user experiences [15] and the associated distinction has even made it into the mainstream media vocabulary, as pointed out by [16]. We borrow from these and associated prior thinking, and in particular find the everyday examples useful for our own grasping of the sometimes very complex differences expressed in theoretical discourse. For us, the first word “*Erfahrung*”, relates to an experience where players actively engage in and gain knowledge from, which can be loosely translated as “learning experience”. One example is “she has a lot of experience juggling”. The second word “*Erlebnis*”, often translated as “lived experience” or “immediate experience”, refers to what could be described as a tacit or pre-reflective experience that, although noteworthy, is not necessarily consciously processed. We believe that in everyday

language, this comes probably closest to when we shout exclamations such as: "What an experience this rollercoaster ride was!". We use three of our past games and play systems, EdiPulse, Copy Paste Skate and HeatCraft to demonstrate the meanings of these two terms in the context of bodily play experiences. Understanding this more nuanced lexicon allows us to identify design strategies that can guide designers when creating future systems.

Without understanding the two different types of bodily play experience in the design of play systems, players may be deprived of gaining full potential of bodily play. Researchers will also be able to use this lexicon to enhance their analysis of player experience. We aim for our bodies to experience digital play not just as another controller [45] but by experiencing our bodies *as* digital play to gain the many physical and mental benefits from such experience.

Our contribution is four-fold: firstly, we introduce *Erfahrung* and *Erlebnis* to game designers and illustrate these two aspects of experience through our design practice. Secondly, we present a suite of design strategies for practitioners aiming to support both aspects of experience in bodily play. Thirdly, we discuss *Erfahrung* and *Erlebnis* in relation to two perspectives on the human body, resulting in, fourthly, a two-dimensional design space with four associated user experiences designers can be aiming for.

2 Related work

Previous investigations in HCI emphasized the need for more research on user experiences that involve whole-body interactions beyond keyboard and gamepad input [44]. For example, Segura et al. highlighted that designers of bodily play experiences should consider the "joy of movement" [64], which aligns to *Erlebnis* as it relates to a lived experience. Mueller et al. [53, 54] suggested learning from sports philosophy to understand bodily play experiences. Their works draw on a set of human values related to *Erlebnis* and *Erfahrung*. For example, visceral sensations like "pain" and "pleasure" can refer to an *Erlebnis*, while the fostering of "consistency" can emerge from reflection on an *Erfahrung* [53, 54].

Past work related to performative dance [33, 75] has also guided our research. Dancers' bodily experiences have immediate (e.g. during the performance) and long-term aspects (e.g. rigorous training to achieve certain moves) that align with our immediacy (*Erlebnis*) and reflective (*Erfahrung*) aspects of the user experience. However, an understanding of how these aspects of the bodily experience can guide game designers in creating such experiences is still needed.

Prior research has also investigated implications for design from our understanding of bodily play experiences, for example, see the work on design guidelines for movement-based games [24, 46]. As these guidelines emerged through working with entertainment companies focusing on Kinect games, they are mostly concerned with *Erlebnis*. Considering *Erfahrung* may produce additional guidelines. Mueller et al. described themes such as "risk" as things to consider when designing bodily play [46]. However, the authors have not yet considered how those themes relate to specific aspects of the bodily play experience, such as when going through it (*Erlebnis*) or reflecting on it (*Erfahrung*).

Tholander et al. [71] examined bodily play in the context of outdoor physical activity. Results suggested that developing interactive systems for endurance athletes should involve multiple perspectives, particularly in regards to how they experience their activity as it happens (*Erfahrung*) and how they reflect on it afterwards (*Erlebnis*). We clarify these perspectives further; as such, we hope that our work also helps to improve design endeavors for such sportspeople.

Despite these prior investigations, several works critiqued that we are only scratching the surface when it comes to technology, the human body and play. Marshall et al. [40] suggested that more theory is needed to improve design practice for bodily play experience. Höök et al. [20] recommended more appreciation of the nuances that bodily experiences entail. Purpura et al. described current designs around bodily experience as too simplistic and in need of further research [60]. Linehan et al. proposed that bodily play designers could benefit from a more detailed understanding of the associated user experiences [32]. A more nuanced lexicon is our solution to these concerns.

The two German words draw from prior phenomenological work investigating experience in relation to bodily interactions with digital technology. Svanæs [70] has previously drawn on phenomenology to understand bodily interactions, highlighting in particular that we often overlook the *Erlebnis* aspect in the design process. McCarthy and Wright unraveled the concept of experience for HCI [41], which has been acknowledged as "one of the most obscure" [10] and "difficult to manage" [56] concepts with a long history of surrounding debate [25, 26]. We propose how a more detailed understanding of *Erfahrung* and *Erlebnis* could better inform the design of bodily play experiences.

3 Experience: Erfahrung & Erlebnis

We suggest two aspects of experience provided by the German language in order to understand bodily play experience better. We propose that looking at the German language might be useful here (similar to how Merleau-Ponty and Eichberg used other languages to unpack a bodily phenomenon [8, 42] and how the German language has been used to unpack experience [15]). The English word "experience" describes both aspects. In German, *Erfahrung* is the traditional German word for experience. It is derived from the Latin "experiential", which used to translate to trial, proof and experiment, but now means "a welter of different things" [25]. The English word "experiment" also derives from the same origin, relating to something active where knowledge is gained; therefore *Erfahrung* refers to a

connotation of knowledge as in "you have a lot of experience playing Dance Central" [16].

Erlebnis is often translated as "lived experience", which is a core idea in phenomenology [74]. It derives from the German word "Leben", meaning "life". The verb form is *erleben* meaning "to live through" (or even "to survive" in the German term "über*leben"*), which does not imply claimed knowledge [16]. It is a meaningful, personally encountered event [15]. As *Erlebnis* is not necessarily processed consciously but pre-reflectively, the knowledge is stored as tacit knowledge [59] – ready to become consciously accessible knowledge in the process we refer to as *Erfahrung*. The word *Erlebnis* also suggests an immediacy with which something real is grasped [72]. Erlebnis, therefore, refers to being alive when something happens [2], as in "What a time to be alive!" or "This was quite an experience!" [16].

Such sentiments closely relate to phenomenology, the study of subjective experience as the basis for meaning-making [67, 73]. Phenomenological thinkers have therefore described *Erfahrung* and *Erlebnis* further. Gadamer described *Erlebnis* as something you have or the immediate living experience [10]. Simone de Beauvoir contextualizes this by proposing that understanding the experiences of women requires looking beyond their biological characteristics and examining how their life experience and body are pre-conceptually constrained [6]. This demonstrates the notion of lived experience and the body: How the tacit dimension of *Erlebnis* is something not chosen consciously, but rather a pre-reflectiveness and consequence of being a body in the world, i.e. what we do before we "think about things". This allows to contrast a pre-reflexive "Lebenswelt" (*Erlebnis*) to a conceptual reflection (*Erfahrung*) [21].

These two aspects of experience are also present in other languages. Merleau-Ponty demonstrates how the French term *corps vécu* consists of *vécu* for "experience" and *corps* for "body", thus meaning "lived body" [74]. He posits that the lived experience is always bodily, as before thought becomes a thought our bodies have already experienced it [42]. Thus, *Erlebnis* is the immediate, pre-reflective, bodily experience based on our actions, while it is prior to *Erfahrung*, which entails conscious processing.

As such, there is a time constraint to *Erfahrung*; it comes after *Erlebnis*. We can also share *Erfahrung* in different ways than *Erlebnis*: Usually we can only share an *Erlebnis* if we are together at the same time and place. But the *Erfahrung* we get from the shared *Erlebnis* can be distributed to and incorporated by others over time: "*Don't' do this – do that instead."* Or: "*You need to have that specific power to conquer the dragon."* Using and sharing the *Erfahrung* of others is a large part of playing games and gives benefits to novel players as well as helps advancing in games, for example see the practice of skipping introductions or sharing powers.

The two aspects of experience can also be found in Chinese: "经验" (jīngyàn) refers to the knowledge or skills someone has gained from practices in real life that can be taught to others, thus is the counterpart to the German *Erfahrung*. "体验"(tǐyàn), which consists of 体 (tǐ) meaning "body" and 验 (yàn) meaning "examine" highlights the personal and subjective bodily perspective of an experience, thus is the counterpart to the German *Erlebnis*.

Ibargoyen et al. [23] says that a lack of understanding these differences has direct implications for everyday design practice (exemplified through unclear job descriptions), which aligns with our argument of the practicality of our work. Along these lines, we illustrate the difference between *Erfahrung* and *Erlebnis* in a sporting situation. Imagine you have just lost a competitive game having played poorly and you are very disappointed. Your coach might say: "Don't think too much about this experience", referring to *Erlebnis*, as the coach wants you to leave it behind as "just" an *Erlebnis* and not focus on the negative consequences. On the other hand, your coach might also say: "Let's look at this experience again and analyze it". Here the coach wants you to consciously learn from this negative experience and turn it into an *Erfahrung*. This highlights how the coach needs to balance which aspect of the experience to highlight: the coach wants you both not to give up and to continue to improve. Therefore, understanding the difference between *Erfahrung* and *Erlebnis* is not just a philosophical enquiry but can be applied to everyday bodily play experiences. Considering this, it is apparent that good design can highlight either an *Erfahrung* or *Erlebnis* aspect of a bodily experience, and we argue that we need to deliberately and carefully craft this.

4 *Erfahrung & Erlebnis* in games and play

We now present past works of existing bodily games and play systems that we have used to derive our design guidance in the form of a set of strategies. Such an approach of reflecting on past systems has been previously successfully used in HCI, in particular by Gaver et al. [13] and Benford et al. [3, 4]. We like this approach and hence selected systems from our work. Our selection covers a range of different technologies, design approaches and implementations. As with most design research projects, we moved back and forth between theory and design practice. This resulted in insights from our own experiences of having designed and played them but also from examining prior work in order to contextualize our findings. In doing so, we intend to exemplify how designers can utilize the terms *Erfahrung* and *Erlebnis* in their practice.

4.1 EdiPulse

EdiPulse [28] is a playful system that explores an appealing food ingredient, chocolate, to represent physical activity data (fig. 1).

Figure 1. EdiPulse prints physical activity data in chocolate.

EdiPulse generates four different representations of physical activity from heart rate data in the form of 3D-printed chocolate treats. These chocolate treats come in four forms: Flower, Graph, Slogan and Emoji (fig. 2). "Graph" shows recorded heart rate values over time. Each petal of a "Flower" represents the amount of physical activity within that particular hour. "Emoji" communicates an individual's progress towards a self-selected activity goal through an emoticon. "Slogan" makes a cheerful comment about the user's daily physical activity.

A two-week study found that edible representations offered new perspectives on self-monitoring and chocolate was viewed as an appropriate treat that rewards an active lifestyle. Eating the edible material was described as an *Erlebnis*, while the varied representations and delayed feedback afforded novel ways to reflect on physical activity and gain *Erfahrung* on a participant's active life.

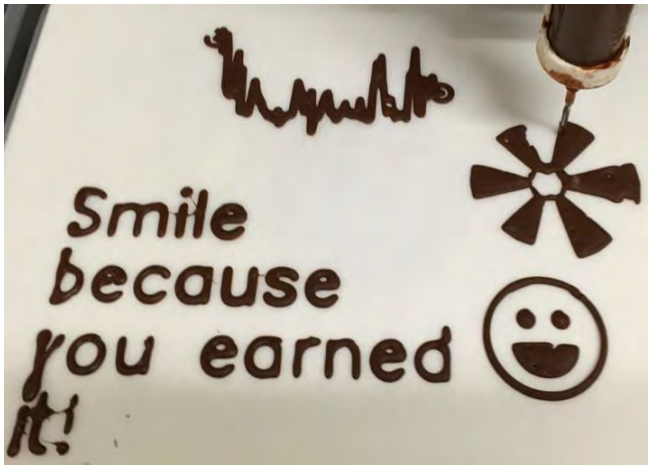

Figure 2. Chocolate treats come in four forms.

4.2 Copy Paste Skate

"Copy Paste Skate" (CPS!) explores how interactive technology can support the experience of performing skateboarding tricks (fig. 3) [57, 58]. The system consists of three main components. Visualizations of the movement path of the skateboard (captured through cameras tracking the skateboard) during the trick are projected onto the environment at actual size (Fig. 4, 5).

Figure 3. Copy Paste Skate.

Secondly, slowed down audio recordings of the trick attempt are re-played through high-quality speakers. A high-performance microphone captures the sound of tricks then our software replays the audio at half speed and at 1.5 times the original volume.

Finally, the entire floor vibrates to the rhythm of the skateboard's movements during a trick through a high-power low-frequency audio transducer. We connected large floor panels and tightly attached the audio transducer, so the vibration travels through the floor panels. A study with 21 avid skaters showed how the system supported their *Erlebnis* of skateboarding ("it brings the tricks to life") while helping them improve their skills and performance, contributing to their *Erfahrung* ("it adds a new level to the skateboarding experience").

Figure 4. The tracking markers and audio transducer.

Figure 5. Performing tricks with Copy Paste Skate.

4.3 HeatCraft

HeatCraft is a playful system that explores emerging technology to facilitate engaging user experiences around bodily awareness [65] (fig. 6).

Figure 6. HeatCraft uses an ingestible sensor and heating pads worn via waist belts.

Two players experience their inner body temperature via localized thermal feedback delivered through a waist belt containing heating pads. The player's body temperature is sensed by an ingestible sensor that travels through the player's body for 24-36 hours (fig. 7). After being swallowed, the sensor collects data of the player's body temperature every ten seconds and transmits it wirelessly to a data recorder. The recorder then transmits the data to an Arduino attached to the waist belt, controlling the heating pads' temperature. The waist belt can be worn around clothes to avoid contact with the skin so players can sense the hot yet comfortable emission. Players can manipulate their internal body temperature data by eating hot or cold food, exercising or moving between cold and warm environments. The inner body temperature between 36.2°C to 37.8°C is linearly mapped inverse to 50°C to 28°C. If the player's body temperature is higher than 37.8°C or lower than 36.2°C [69], the heating pads' temperature is set to 50°C as a warning signal. The lowest temperature setting is experienced as slightly cold, while the highest setting is experienced as slightly uncomfortable.

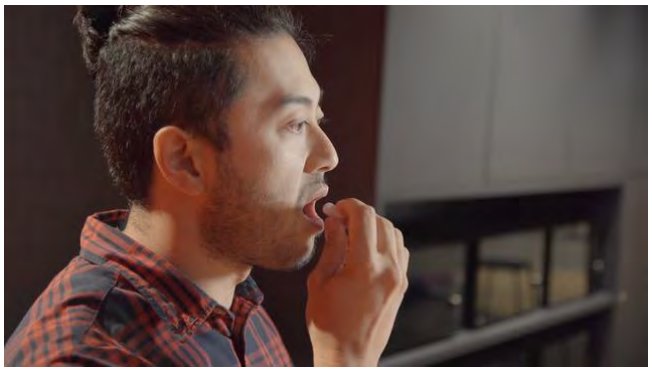

Figure 7. The ingestible sensor used in the HeatCraft system.

Because the play is open-ended, the two players are free to perform any activity during the 24-36 hours to experience the system in different contexts, such as eating hot food, drinking cold drinks or exercising. Players can also create their own game rules together. In our study, players were observed competing against each other to see who can first change their heating pads' temperature to 50°C. The play ends when the two players excrete their sensors (which was also turned into a game, with players competing who excretes the sensor first, aided by frequent toilet visits).

Erlebnis is demonstrated in HeatCraft as the feeling of inner body temperature through heat sensations. Participants demonstrated bodily awareness where one commented: "*[The system] allows you to actually feel your temperature through your body!*". Another expressed: *"It increased my bodily awareness by giving me a constant update of my body temperature from the heating pad". Erfahrung* is shown when participants demonstrated increased bodily knowledge by noting how experiencing the system taught them more about their own bodies. They expressed how their inner body temperature changes more rapidly than they thought. Another participant expressed that the system helped her know more about her digestion rate: *"Now I know it takes about three days for the pie I eat to travel through my body."* This emphasized how the combination of *Erlebnis* and *Erfahrung* contributed to an increase in both bodily awareness and bodily knowledge. These factors are part of bodily intelligence which describes the extent of one's bodily awareness and bodily knowledge and what the individual does for and with the body [14], which can contribute to self-attunement, leading to a healthy and vibrant life [14].

5 Design strategies to support both *Erfahrung* and *Erlebnis* in bodily play

This section presents a set of design strategies we derived based on our experiences of designing, developing, playing and studying the above games and play systems. The goal is to provide designers with a better understanding of how they can utilize the two aspects of experience – *Erfahrung* and *Erlebnis* – for designing bodily play systems. Designers can still focus on only one of the two aspects. However, the inclusion of both is arguably preferable as it can lead to

more design choices, an outcome previously argued to be desirable [70].

The strategies have emerged through an iterative process in which thinking about the player experience has also influenced our design practice [45, 51]. We acknowledge that our process was not pre-planned from the outset, but rather emerged organically as being the result of the messy design practice in a research lab. Thinking about *Erfahrung* and *Erlebnis* was interspersed with whiteboard sessions, which were complemented by "tinkering" processes [17] while being supplemented with affinity diagrams and "thinking through writing". Discussions with senior lab members who were involved in the original designs were complemented by conversations with new members who were not part of the original design team. We highlight that the lab members come from various countries, which enabled us to consider the meaning of the words *Erfahrung* and *Erlebnis* across a few other languages besides English and German such as Chinese, Dutch, Norwegian, Danish, Marathi and Sanskrit.

We acknowledge that more analytically-oriented labs, such as media or psychology departments, could potentially produce more structured approaches towards analyzing our systems. However, as we aim to influence game designers, we believe that there is value in learning "from the trenches" and engaging with the reality of a game design research lab and its opportunities and limitations. With this approach, we aim to provide knowledge about bodily play experiences that is abstract, yet close to design practice. We note that such an iterative process has also been used previously to develop an enriched understanding of how to design user experiences around sensed movement [3], proxemics-aware play [51] and different perspectives on the body during play [45], hence we believe our results also have merit.

This set of strategies is not an exhaustive list, but rather a starting point. Nevertheless, we hope that through our design strategies, we begin laying out a structured foundation towards the design of bodily play experiences.

5.1 Consider facilitating to turn *Erfahrung* into an *Erlebnis* itself

This strategy is concerned with the extent to which the system facilitates to turn the *Erfahrung* into an *Erlebnis*. In many traditional systems, the sensed data from the *Erlebnis* (such as sensed movement data) is provided on a screen to the player afterwards for reflection (*Erfahrung*). For example, jogging apps provide heart rate data after the run numerically and graphically on a mobile phone screen. Here, the initial *Erlebnis* is supported by an opportunity to reflect on it, with the data visualization aiming to support the *Erfahrung*. Designers can facilitate turning the reflective *Erfahrung* into an *Erlebnis* by using technology beyond the screen instead of presenting data as numbers and graphs.

For example, Edipulse does not present the user's physical activity levels on a screen but in the form of chocolate. Both a screen and chocolate support *Erfahrung* through reflection on the amount of physical activity performed, however, the use of chocolate turns the reflection into an *Erlebnis* through its multi-sensorial appeal and positive emotions associated with chocolate. Participants of the associated in-the-wild [62] study reported how their family members participated in the tempering of the chocolate as a fun mini-cooking activity and the smell of chocolate was enjoyed by everyone in the house. This appeared to extend the physical activity part of the personal experience to a social event. Furthermore, the eating of the chocolate was an energy "intake" replenishing the "energy-out" resulting from physical activity. The end result was a multi-sensorial *Erlebnis* through the opportunity to reflect on the physical activity data. Participants reported that using chocolate to reflect on data not only provided much information about one's physical activity but made the data reflection enjoyable and appetizing. Nevertheless, we acknowledge that turning an *Erfahrung* into an *Erlebnis* through presenting data in novel and exciting ways (such as through multi-sensory means like 3D-food printing) might be limited once an initial novelty appeal wears off. For now, we suggest designers to consider facilitating to turn the reflective aspect of an experience (*Erfahrung*) into an *Erlebnis* itself and highlight the opportunity of engaging novel interfaces to do so.

CPS! also aimed at turning the reflection on the sensed data into an *Erlebnis*. The system achieves this by supplementing the visuals resulting from the tracked data of the skateboard with audio: the audio is played back through high-end speakers and also filtered and repeated several times, before fading out. Furthermore, the floorboard vibrated with the same repeating pattern based on the tracked data. The idea was to turn reflection on sensed data into a multi-sensorial *Erlebnis* through which skateboarders could reflect on their activity.

HeatCraft also aimed to turn the *Erfahrung* derived from reflecting on bodily data into an *Erlebnis* by providing heat sensations to the user instead of displaying the data on a screen. Allowing users to "feel" their inner body temperature prompted them to reflect on how their bodies responded to hot food and exercise. This can lead to a form of bodily awareness that is qualitatively distinct from any bodily awareness as a result of perceiving data presented on screens that mostly focuses on information dissemination, as previously already alluded to by the work on somaesthetics [18].

5.2 Enlarge physical and temporal disparity to amplify Erfahrung aspects

Designers can consider physical and temporal disparity as a way to facilitate amplifying or dampening *Erfahrung* and *Erlebnis* aspects to support bodily play. Physical disparity is the physical distance between a system's input and output [12, 45]. For example, the physical disparity in a typical computer desktop setup is approximately 40 cm as this is the distance between the mouse and the mouse pointer on

the screen. On a tablet PC, the physical disparity shrinks below a millimeter as the input and output is only separated by a thin glass surface. Similarly, with temporal disparity, we mean the duration between input and output: the delay between moving a mouse and the mouse pointer moving is usually so small that it appears instantaneous. However, in the early days of computers the CPU was often overloaded, which lead to "mouse lag", resulting in frustration. Therefore, designers need to consider temporal disparity between input and output. We argue that designers can deliberately play with this disparity in order to either amplify or dampen the *Erfahrung* and *Erlebnis* aspects in order to support a bodily play experience.

Edipulse uses disparity quite extensively. The user's physical activity is sensed through a heart rate monitor attached around the wearer's chest. This data is deliberately *not* made available immediately to the user so it will not interfere with the *Erlebnis* of living a physically active life. Instead, the output is delayed until the evening (temporal disparity) in order to support reflection at the end of the day. As such, the *Erfahrung* is delayed to a time of rest which suits reflection. There is also a physical disparity between the sensor on the wearer's chest and the 3D chocolate printer that outputs the data. This disparity is rather small if we compare it to a setup where the 3D printing process would have been outsourced to an external company, producing the chocolate pieces offsite. Having the 3D printing process in the participants' kitchens appeared to support the *Erfahrung* aspect of the experience. Participants reported that being able to guess what letters of the motivational message were printed next was intriguing for them as they watched their data "unfold".

CPS! also employed physical and temporal disparity, which can be used to support the bodily play experience through *Erfahrung* and *Erlebnis* aspects. The physical disparity between the input (the tracker on the skateboard) and the visual output (the projection on the wall) was carefully considered. The distance between them needed to be large enough to safely perform the skateboarding tricks, but also small enough to ensure that participants could immediately identify that the visual is a representation of the skateboard trick that was just being performed. The projected image was only displayed after the trick, but a different tracking technology could have also displayed the projection *while* the trick was being performed, supporting more strongly the *Erlebnis* aspect of the experience. Nevertheless, the projection was displayed later, supporting the *Erfahrung* aspect of the experience. It was observed that the participants discussed their tricks while moving their skateboard in their hand along the projected line, talking about how it travelled through the air in a slow-motion kind of fashion. Here, the skateboard was moved closer to the visual representation, reducing the physical disparity, something that would have not been possible in a safe manner during the trick. The haptic feedback through the audio transducer also employed physical disparity: the audio transducer was placed near the landing zone to support the *Erlebnis* aspect, but also close to where participants would discuss the trick, supporting *Erfahrung*.

HeatCraft also used disparity to amplify different aspects of the experience. An ingestible interface requires careful consideration of physical disparity, as including an output device in the pill is challenging. A display would not be visible to the user, and a haptic actuator has a risk of causing internal damage to the body. Therefore, any output is likely to be significantly distant from the sensor. In our case, this distance was approximately 3-40cm away from the pill in the form of the heating pads on the body, depending on the location of the pill, which is difficult to sense. The physical disparity was used to allow participants to "feel" their inner body temperature on the outside thus facilitating *Erfahrung*. Locating the output on the player's skin allowed the co-player to touch the heating pads, supporting the comparison of system outputs between the two players. This provided participants with a means for building bodily knowledge. For example, one participant said: *"When we were physically together, we tried the same activities to see who can change the body temperature quicker"*. It is noteworthy that the physical disparity was not as large as in medical systems that display inner body temperature on a clinician's display, often not accessible to the user. Instead, the physical disparity was reduced in order to support the participant's *Erlebnis*.

5.3 Identify opportune moments to facilitate *Erfahrung* during *Erlebnis*

This strategy suggests facilitating reflection (*Erfahrung)* during opportune moments of a lived experience (*Erlebnis)* and highlights that interactive technology is particularly useful in identifying such moments. The value of opportune moments has been previously highlighted in sports-HCI work [54], drawing on the Greek differentiation between opportune times for action and chronological time (i.e. the time the clock shows). To understand the notion of opportune moments, one can look in the context of traditional sports. For example, coaches often await these opportune moments during a sporting event, however, the actual clock time might be perceived quite differently. Although participants are often occupied, both cognitively and physically during the activity, there can be moments for reflection. The human body eventually tires during bodily play and therefore needs rest periods. These rest periods can be used as opportunities for reflection. Interactive technology can also identify rest periods and when gameplay does not require full exertion. Sensors can identify these opportunities, whether through an enhanced understanding of the game (achieved through, for example, tracking the location of the ball) or through sensing overexertion (achieved through, for example, biosensors). Knowing when these rest periods are supportive, and not detrimental, allows opportune moments to facilitate *Erfahrung*. The opportunity of using these rest periods is that the system can support *Erfahrung* through highly

personalized reflection, based on the most recent sensed bodily actions.

Edipulse does not provide opportunities for facilitating *Erfahrung* during *Erlebnis* aspects as the system only provides access to the bodily data after the physical activity occurred, at the end of the day. However, we can envision future versions of the system where wearable 3D chocolate printers could offer moments for reflection (*Erfahrung*) during the day when the system detects downtime.

CPS! also does not currently provide opportunities for facilitating *Erfahrung* during *Erlebnis*, mostly because skateboarding tricks are usually very short. Future versions of skateboarding support systems could, for example, provide opportunities for reflection (*Erfahrung*) in-between two tricks, especially when using momentum gained on a skate park ramp. Using sensors to identify opportune moments within two consecutive tricks is also an interesting area for future work.

HeatCraft's heating pads can be used to facilitate *Erfahrung* aspects during the *Erlebnis* of having swallowed an ingestible pill. Instead of using a screen that requires users to explicitly pay attention to it, heat is used as an output modality to facilitate *Erfahrung* at opportune moments. A comparison with the GutsGame [31], which uses an ingestible sensor with a mobile phone app, highlights how the *Erlebnis* of having swallowed an ingestible sensor is divided into two modes. The first mode is when the user conducts daily activities with the sensor collecting data inside their intestines. If the player wants to engage with the sensor data to turn the *Erlebnis* into an *Erfahrung*, she/he needs to look at the phone and interact with it thus disrupting daily routine [31]. A better approach would involve the system somehow sensing opportune moments of the *Erlebnis*, thereby providing more suitable opportunities for *Erfahrung*.

5.4 Employ sensations for *Erlebnis* and perceptions for *Erfahrung*

This strategy is concerned with the extent to which the system considers employing sensations to aid the support of the *Erlebnis* aspect. This contrasts the use of technology to support perceptions, which lend themselves for *Erfahrung*.

We differentiate between sensation and perception. Prior work on bodily play has also drawn on this distinction [45]: Most interactive systems for bodily play make use of screens and audio, hence supporting perceptions. Perceptions of one's own body arise from "localized sensations", felt mainly through touch, pain, proprioception (i.e. the "internal" perception of bodily posture and bodily boundaries), kinesthetic sensations (i.e. the "internal" perception of bodily movement) and temperature perception [66]. Unlike screens and audio, these localized sensations support the *Erlebnis* aspect by allowing the player to experience their bodies. In contrast, seeing an image on a screen results in perceiving the information displayed, but this information belongs outside the perceiving body [66]. As such, we recommend to designers to consider employing sensations for the *Erlebnis* aspect rather than using screens in bodily play that support perceptions, which lend themselves more to *Erfahrung*.

Edipulse can be seen as possibly supporting the *Erlebnis* aspect through taste sensations that are "reflected in one's own body" in the form of data being eaten rather than displayed on a screen. A future work for the system supporting the *Erlebnis* aspect includes providing haptic feedback on the participant's body through augmented T-shirts if particular heart rates are reached during physical activity.

CPS! uses sensations that could facilitate supporting the *Erlebnis* aspect through haptic feedback: An audio transducer provides the skater with a haptic sensation, felt through their legs as a reflection of their own body. The system also supports perceptions through the video and audio, demonstrating that perceptions and sensations can intertwine to support the overall experience.

We believe that HeatCraft can use the sensation of heat produced by heating pads to support the *Erlebnis* aspect of having swallowed an ingestible sensor that senses body temperature. The system could have also used perceptions, such as a screen displaying temperature data, as demonstrated by Li et al. [31]. However, the design was inspired by the intriguing opportunities of using heat as output modality [27], which appeared to support the *Erlebnis* aspect.

5.5 Extend both *Erfahrung* and *Erlebnis* aspects to spectators

Prior work has argued that interactive technology can be used to engage spectators [61]. Bodily play often involves gross-motor movement that is easily visible to others (in particular when compared to traditional mouse and keyboard interactions); hence it lends itself to engage spectators [24, 49]. As such, we recommend facilitating extending both *Erfahrung* and *Erlebnis* aspects to engage bystanders and audiences.

We believe that Edipulse can extend both *Erfahrung* and *Erlebnis* aspects to spectators. *Erfahrung* was engaged with via the 3D printing process of chocolate in the participants' kitchens at home to engage bystanders. Participants reported that the slow printing process of a 3D printer was not a problem, but rather an opportunity for family members to stop and watch the data being revealed. Furthermore, the tempering of the chocolate resulted in a smell that attracted other family members in other parts of the house. We see this in contrast to a mobile phone screen that shows data immediately and in a very private manner. We can envision future systems that also employ smell as a way to engage spectators not just after the main activity, but during the *Erlebnis* itself.

We find that CPS! can extend *Erlebnis* aspects to spectators by amplifying the sensed data so that people passing by

could get a sense of the experience as it happens. The system included two high-end projectors in order to have the skateboard path be visible to bystanders even in bright daylight outside. Furthermore, the audio was played rather loud to reach audiences. The audio transducer was also a high-performance item (up to 1500 watts) and screwed onto interconnected boards that reached not only the skateboarder but bystanders. The audience's *Erfahrung* was supported through having the visual freeze after the trick occurred so that the audience could reflect on it. This was supplemented by repeated audio, further facilitating reflection by bystanders.

Slightly different from Edipulse and CPS! HeatCraft could extend *Erfahrung* and *Erlebnis* aspects to spectators indirectly. In terms of *Erfahrung*, the system required players to wear a waist belt while doing physical activities in public to change their body temperature. The waist belt and the physical activity could serve as a social facilitator since the spectators might ask players about what they were wearing or doing. Through the conversation, a spectator could gain second-hand bodily knowledge. Moreover, the spectator could increase *Erfahrung* by acting upon the players by feeding the player or touching the heating pads to understand the relationship between body temperature and diets. Some participants reported that they allowed their close friends and family members to touch their heating pads. They may also let the spectators wear the waist belt in order to feel their inner body temperature (the transmission distance between the data recorder and the Arduino is about 100m). We can envision alternative versions where the *Erfahrung* and *Erlebnis* aspects are extended more directly. For example, the sensor data could be shared online so that a crowd-sourced community could help support reflection on what is happening inside the participant's body. The heating pads could be augmented with LEDs that communicate to audiences when the temperature rises or drops. This could create a public performance as audiences engage with the system.

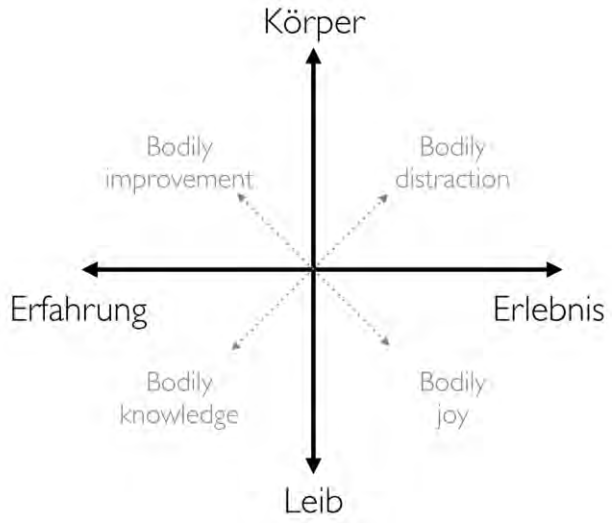

Figure 8. Erfahrung-Erlebnis meets Körper-Leib.

6 Erfahrung-Erlebnis meets Körper-Leib

Prior work in game design [45] based on general HCI-phenomenology work [70] has previously used German words to highlight two different perspectives on the human body to aid bodily play designers: *Körper* and *Leib*. In phenomenology, the notions of Körper and Leib were first introduced by Husserl [7, 11, 22, 59, 78] and later rephrased and further developed by Merleau-Ponty [42] as the *corps propre* (*Leib*), the subjective body; the sum of a subject's experiences acting and interacting in the world, and *corps objectif* (*Körper*), the objectified body; our operational body constituted by and among other bodies [11, 42, 43, 77, 78].

In this article, the other two German words introduced, *Erfahrung* and *Erlebnis* are being used to highlight two different aspects of a play experience. They are not different perspectives on the same thing (as *Körper* and *Leib* offer two perspectives on the body), but rather two parts of a whole. We believe that knowing these four terms can enhance our understanding of both the body and experience, which ultimately cumulates into a more holistic conceptualization of how to design bodily play experiences.

We now discuss how the two aspects of experience, *Erfahrung* and *Leib*, relate to the two perspectives on the human body, *Körper* and *Leib* [45]. We can examine *Erfahrung-Erlebnis* and *Körper-Leib* through the diagram below (fig. 4). We use dimensions to depict the German terms not to point to a separation of the body into two different entities, but rather to acknowledge the reciprocal relation between them [42], which we believe designers can draw from. Furthermore, we argue that it might be beneficial if designers examine the resulting design space in order to identify which quadrant they design for, as it can help identify the resulting user experience and hence provide guidance for the structure of the design process. We propose that designers can design for all quadrants (but might need to shift across them throughout the temporal aspect of the experience), however, they can also design "against" a quadrant to facilitate incoherence as a way to, for example, provoke as part of critical play [9]. Overall, the different foci constellations designers can take during the design process will help us conceptualize the design of bodily play experiences.

6.1 Bodily improvement

In the upper-left quadrant sit bodily play systems that treat the human body as an object (*Körper*) and aim to facilitate an *Erfahrung* experience. Typical examples include sports science systems that focus on improving athletic performance. They commonly do not consider how the user feels about bodily activity (so stressing not the *Leib*, but the *Körper*). Furthermore, they are usually not designed to support the immediate *Erlebnis* (in contrast to, for example, gamified sports systems, e.g. [35], that reward individual actions with points or special effects) but focus on athletic improvement for an upcoming competition (*Erfahrung*). CPS! sits in this quadrant as it allows skaters to gain

Erfahrung through reflecting on their trick while focusing on the *Körper*, which is reflected through the movement of the skateboard. Popular commercial examples in this quadrant are jogging apps such as Nike Run Club, Runkeeper and Strava that aim to improve the *Körper*'s athletic performance by allowing for the gaining of *Erfahrung* through reflection on past *Erlebnis*. We call the user experience resulting from engaging with such systems sitting in this quadrant "bodily improvement".

6.2 Bodily Distraction

In the upper-right quadrant sit systems that view the body from a *Körper* perspective and focus on the *Erlebnis* aspects of the experience. One example is jogging on a treadmill while playing a videogame, where the videogame is not connected to the treadmill, i.e. not dependent on exertion input [50]. This can foster an in-the-moment *Erlebnis*, while the material body (*Körper*) is engaged. Many modern gyms support such setups. For example, there are exercise bikes that have in-built screens where checkers can be played while cycling. We call the resulting user experience "bodily distraction", as digital *Erlebnis* is used to distract from the *Körper* investment.

6.3 Bodily Knowledge

In the lower-left quadrant sit systems that support the lived body perspective (*Leib*) and reflection (*Erfahrung*). Games and play systems that aim to teach players about their body using embodied means are typical examples here. HeatCraft aims to facilitate increased bodily awareness of one's body temperature through ingestible sensor data that is reflected in the player's body through heat sensations. Similarly, EdiPulse focuses on *Erfahrung* in regard to physical activity, but in contrast to quantified-self apps, it achieves this by focusing on the *Leib*. The resulting user experience can be described as one focusing on "bodily knowledge".

6.4 Bodily Joy

In the lower-right quadrant sit systems that focus on in-the-moment experiences (*Erlebnis*) and view the human body from a *Leib* perspective. Examples include rollercoaster rides that draw on the unique bodily sensations resulting from rapidly moving the human body around. Rollercoasters employing VR [34] are stretching this *Erlebnis* aspect even further, as the *Leib* is deceived to be moving even faster and rocking more left and right, as the VR world matches the real-world rollercoaster movements in a slightly exaggerated way. The user's *Erlebnis* is heightened, possibly through the amplification of the positive emotions the *Leib* feels about being moved along the rollercoaster tracks. CPS! also focuses on *Erlebnis* through the *Leib* if we examine it from a spectator perspective. Spectators are enabled to enjoy the associated sensations that come with having performed a trick successfully through the system, allowing them to feel to some extent what the skateboarder experiences (*Erlebnis-Leib*). We describe the resulting user experience as one focusing on "bodily joy".

7 Limitations

We acknowledge that our work has limitations. Firstly, we acknowledge that we only provided a basic definition of the term "experience". Nevertheless, we believe our work can serve as an easily approachable introduction for game designers with no prior exposure to delve deeper into *Erfahrung* and *Erlebnis*. We have also not yet discussed if and how our work could be used for a broader HCI context beyond play. Furthermore, we acknowledge that we have also only begun to fully consider the social aspects of the experience. Examining prior work on social play in bodily games [29] from the 2nd person perspective derived from phenomenology [70] could be useful here to go deeper. Lastly, we have also not yet fully considered experiences of players with injuries or disabilities. Further investigations might highlight that a resulting *Erfahrung* might be the same for players with abilities or disabilities yet their *Erlebnis* might be very different (and vice-versa). As such, we hope our work can also contribute to an ethical discourse on the body in games.

8 Conclusion

Interest in supporting bodily play experiences continue to grow within HCI's game design community. However, scholarly work has proposed that a better understanding of the bodily play experience is still needed to facilitate better design guidance. We contribute to this understanding by borrowing from the German language the two words *Erfahrung* und *Erlebnis* that describe two aspects of what English defines both as "experience". By looking at our bodily play systems and related work, we discuss these two aspects and suggest implications for design. We believe that our insights based on personal design practice can serve as an initial starting point for others to build upon.

In summary, our work aims to contribute to a better understanding of bodily play experience. We believe this better understanding of player experience based on the concepts of *Erfahrung* and *Erlebnis* can facilitate better designs. Through this better understanding, we hope that designers are able to support players in both gaining experience through their bodily play while also experiencing their bodies through play. We hope that improved play systems based on this more nuanced vocabulary allow players to profit from the many benefits of engaging the human body through play.

ACKNOWLEDGEMENTS

We thank all the members of the lab who have helped with this work and all our study participants and lab visitors who have provided feedback on our designs. The Exertion Games Lab appreciates and acknowledges the support of the School of Design at RMIT University.

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