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# The Move Maker – Exploring Bodily Preconditions and Surrounding Conditions for Bodily Interactive Play

**Louise Petersen Matjeka**

Norwegian University of  
Science and Technology  
Trondheim, Norway  
louise.matjeka@ntnu.no

## **Abstract**

Interest in interactive bodily play and game design has increased during the last decade, often fueled by the medical industry's focus on exergames and a need for basic movement training. By dividing bodily interactions into bodily preconditions and surrounding conditions for interaction, Move Maker systematically explores basic bodily play dynamics in combination with digital interactive devices. This way, Move Maker offers a movement-based game system challenging basic movement abilities through bodily play explorations.

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Move Maker is designed for elderly people to play with their grandchildren (through a suite of ready to play minigames) and for designers and physiotherapists wanting to explore and develop novel bodily play constructions.

## **Author Keywords**

Bodily play, movement based game design, embodiment, interaction design, exergame, game system, design game.

## **CSS Concepts**

• **Human-centered computing~Interaction design~Systems and tools for interaction design.**

## **Introduction**

Designing for bodily play in HCI is gaining traction [1,12] along the development of exergames in the field of serious games [9,11]. Also tools for innovating and developing novel bodily play experiences has been introduced to the field [13,14]. Move Maker, the game system presented here, is a contribution to this compound field of designing for bodily play and movement in HCI: A suite of movement-based games for elderly people to challenge their movement abilities, and a system for designers to systematically explore bodily play dynamics for digital game design.

## Categories of Bodily Preconditions and Surrounding Conditions for Bodily Play

### **Preconditions:**

1. *Fixation of body parts* (e.g. to a device (as in JSJ), the floor/walls, body part, other players etc.)

2. *Exclusion of body parts* (e.g. not to use feet to play the ball in handball and hands in football)

3. *Deprivation/manipulation of body senses* (e.g. the balance sense in BN, blindfolded, ears muffled etc.)

### **Surrounding Conditions:**

1. *Designations or marking of fields, zones, goals, mats etc.*

2. *Objects to avoid, collect, pass by, turn on/off, protect, get rid off etc.*

3. *Conditions affecting the surrounding atmosphere* such as light, sound, smell, heat, outdoor/indoor, grass, etc..

In the effort of researching bodily play, Move Maker explores the bodily play dynamics arising from dividing interaction into *bodily preconditions* and *surrounding conditions* for interactions with a game system. It does so from the phenomenological understanding that bodily perception is active, meaning that bodily experience is not only affected by the thing with which we interact, but also by our bodily preconditions as the basis for our actions (before interaction) [15,18]. In a play perspective, bodily preconditions are instated bodily handicaps. These dynamics have not gained much attention in the field of bodily play and HCI yet, however, some significant work has been done.

### *Related Work with Playful Bodily Preconditions in HCI*

Within the field of HCI and bodily play, Byrne [1] explored manipulating the balance sense (vertigo) in their Balance Ninja game [2]. Manipulating the balance sense is a way of altering the players' bodily preconditions for interaction in the game and thereby create bodily play. In the performance event Inferno, Demers and Vorn [4] explored controlling the participants' bodily preconditions for movement through an exoskeleton (on the upper body, the participants had full control over the lower body). The exoskeletons were externally controlled live by a choreographer. Die Gute Fabrik explored limiting players' bodily preconditions for movements in their game Johan Sebastian Joust (JSJ) [5]. In JSJ, players are to keep their move controllers "still" to the rhythm of J.S. Bach's Brandenburg Concertos music, while at the same time pushing or in other ways make the other players move their controllers beyond the allowed threshold. By narrowing down the allowed movement threshold of the move controllers, the players' bodily preconditions for actions in the game become limited

and the bodily possibilities for interaction are altered. Such mechanics are also found in e.g. Twister [19].

### *Move Maker*

Move Maker explores similar bodily play dynamics of limiting bodily preconditions for interaction and the emerging implications for bodily perception and subsequent perceived interaction possibilities. However, it does so systematically: It offers a system to apply any body part in question in combination with any of the categories of bodily preconditions (sidebar). From these categories any physical exercise can be analyzed and thus applied to the game (e.g. walking on forefeet = your heels are not allowed to touch the ground). Specifically, these are developed into a set of cards to be dealt during the game. Likewise, the things players interact with are categorized (*surrounding conditions* – sidebar). Through combining these elements with either a play-thing and/or a game objective, a system of (almost) infinite possibilities for bodily play is created. As such, Move Maker is both a suite of predefined movement-based games and a game system offering designers and physiotherapists a way to explore these bodily play dynamics systematically, separate and in combination designing for bodily play.

So far, five predefined minigames with a duration between 5-15 minutes are developed. Two of these are listed in the sidebar (p.5). Common for the minigames is that players end up in awkward bodily positions as a kind of bodily puzzles, where they have to solve how to move around anew while pursuing the game objectives.

### *Background and Purpose of Move Maker*

The motivation for the design originates in the arising need to design balance training games for fall



Figure 1: Getting the robot through a maze while avoiding laser lines by collaborating.



Figure 2: Avoiding the laser lines and turning the light cubes red on the way.



Figure 3: The placement of the objects is variable to suit player abilities and preferences.

prevention. The target group is elderly people (60+), healthy but not used to regular physical exercise. Due to little bodily challenge in their daily lives, their movement repertoire narrows: Movement repertoire is a person's (individual) diverse set of movement abilities [16] e.g.; getting the head up and down, stand on one leg, stretching to the sides, etc.. Decreased movement repertoire leads to increased risk of falling because it leads to less confidence in own movement abilities and thus, less joy of movement with the consequence of less movement in general [Fuglem and Granbo, personal communication]. While the target group is (still) healthy, the main challenge then is to keep their movement repertoire active and diverse through joyful movement. A way to achieve this is by (gently) challenging the players' movement abilities. This is the goal for Move Maker; gently challenging the players' movement abilities through play and thereby maintaining their movement repertoire.

### The Game Design Process

Move Maker was created in a Research through Design [7] process theoretically informed by phenomenology together with play and game theories along the practical design work.

The practical foundation for the game development is a set of exercises developed by physiotherapists especially for fall prevention [Fuglem, personal communication]. And, because most elderly want to play with their grandchildren, this was found to be a proper situation to design for.

### Theoretical Grounding

A phenomenological perspective on bodily experience is that bodily perception is active [15]. In action and

through our senses, we perceive the world and the elements of our equilibrium get reshuffled [10]. This creates a momentary disorientation onto a new orientation. In this process the body acquires new knowledge and skills [10].

From play and game studies, the game design of Move Maker has been informed by Suits definition of games as; "*unnecessary obstacles to overcome*" [17] and Caillois' similar definition of games constituted by "*arbitrarily chosen obstacles to overcome*" [3]. The viewpoint that play is driven by curiosity [6,8] has also guided the design process, as it is curiosity that bridges play and bodily perception: When the bodily equilibrium gets reshuffled by arbitrarily chosen and unnecessary obstacles, the body's curiosity is evoked in a kind of questioning like; "How can I overcome this?", "How will this feel?" "Can I do it?" [6].

### Basic Bodily Play Dynamics in Ball Games

From the assumption that the ball is a very popular play technology yielding an infinite range of bodily play possibilities, ball games were found to be an ideal starting point to investigate basic bodily play dynamics. The guiding question was: What are the common denominators constituting this range of diverse (ball) games? With the sub-question: How can interaction with a ball yield so many different games?

From these investigations, three constituents emerged: 1. A plaything; the ball, 2. Players' bodily preconditions for action (often constituted by rules); bodily limitations such as in football (soccer), players are not allowed to interact with the ball using their hands (with some exceptions). This rule is reversed in handball. In tennis, the players use a racket for interacting with the ball,

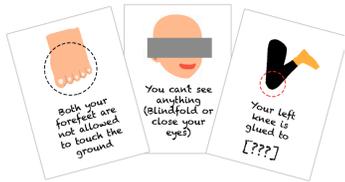


Figure 4: Different precondition cards: left; exclusion of forefeet, middle; deprivation of sight, right; fixation of left knee.



Figure 5: The play-thing and the surrounding objects: Laser lines, light cubes and music cubes.

similar to e.g. cricket, and 3. Surrounding conditions for interaction; markings of fields and zones, goals, grass lanes, indoor/outdoor etc. Both as single and combined elements these constituents create different obstacles to overcome and thereby constitute the defining part of a game's rules together with the objective of the game.

### The Game System

The Move Maker system is made up of the three constituents as derived from ball games listed above; a plaything, bodily preconditions and surrounding conditions. The latter two elements are further divided into three categories each. These are listed in the sidebar (p. 2) and elaborated below.

#### Driving Robot as the Play-thing

The play-thing (figure 5) in Move Maker is a moving robot made of Cubelets from Modular Robotics and Modu® elements. Controlled by proximity sensors, the robot only drives forward and twists to the sides. The robot's functionality is deliberately kept simple just as the ball, albeit with digital interactive behavior. The play-thing can take on different functions; as a ball to score goals, a racing device, a thing to not be touched by or get through a maze, etc., or it can be left out.

#### Cards Instating Bodily Preconditions

The bodily preconditions are divided into three categories listed in the sidebar (p.2). These are developed into a set of cards (figure 4) in the following ways: To fixate a body part, the cards carry the phrase; "Your [body part] is glued to [??]", where the question marks are to be defined by the players (e.g. the floor, the cube, your leg etc.). Similarly, to exclude a body part; "Your [body part] is not allowed to [??]" (from touch the floor/play-thing, cubes or to control

e.g. the play-thing etc.). To deprive a body sense, the cards carry phrases like; "You are blindfolded" or "Muffle your hearing". There are two levels of cards (figure 4); incomplete as in the previous examples and complete with full definitions (e.g. touch the ground). Lastly, "remove" cards are included for the players to be able to remove bodily preconditions as well.

#### Tangible Objects as Surrounding Conditions

Similar to the bodily preconditions, the surrounding conditions are divided into three categories (sidebar p.2). These are implemented in Move Maker by a set of interactive objects (figure 5). As argued below, these objects can take on functions from all categories, however, each group of objects is developed with the purpose of one category in mind. Objects included in Move Maker are: Laser lines, Light cubes, and Music cubes. The main idea behind these objects is that they are mobile to be distributed around the physical space.

*Laser lines* consist of laser lights in one end and a Cubelet brightness sensor connected to a Cubelet speaker (bipping) in the other end. When the line is broken, the speaker makes noise. These are designed to mark off the play space but can function as objects to avoid, jump over, limbo under or as collectable (break the line). The sound in the laser lines can also contain music affecting the surrounding atmosphere.

*Light cubes* (from Hippomini) are cubes that change color according to which side is down. These are initially implemented as objects to collect, avoid, change color etc. However, these can just as well mark off spaces or zones through their coloring; red or blue zone, or red = no entry, blue = only exit etc..

### **Minigame: The Maze**

2+ players. Players collaborate to get the robot through the maze and change all light cubes' color to red. Make a maze by distributing the light cubes around the floor in different colors except red. Each player draws a precondition card (first card cannot be a remove card). For each light cube you pass draw a new card (remove cards apply).

#### *Extra Rules*

Use the laser lines as walls that neither you nor the robot can break.

### **Minigame: Get through the Laser Field**

1+ players. Get through the laser field without breaking the lines. Create a field of laser lines in varying heights. Each player draws four cards. Apply a new for each line passed. Only one remove card is allowed to use at a time (each player has at least one bodily precondition).

#### *Extra Rules*

Place light cubes around and change colors on your way.

*Music cubes* add music to the game as a way to affect the surrounding atmosphere of the game while also being an object to interact with. The music is controlled by a proximity sensor that basically turns the music on for five seconds: one plays harmonics, the other the beat. So far, only music cubes are included in Move Maker, however, as objects affecting the games' surrounding atmosphere, cubes including smell (diffuser), or wireless light controllers can be added.

#### *The Minigames' Gameplay*

Players play the minigames just by following the rules. Each minigame has a set of extra rules to vary and advance the games. The extra rules also present alternatives as a way to kickstart the players own creativity and customize the minigames. It is the interplay between handicapping the players in arbitrary ways through bodily preconditions and the interaction with the arbitrarily distributed surrounding objects, that creates unforeseen bodily experiences. The randomness in the dealt cards together with different placements and characteristics of the objects combined with different game objectives, create infinite bodily challenges and thus bodily play possibilities.

#### *Status of Move Maker*

Currently, Move Maker is developed as a prototype and play-tested in the lab (figure 1,2,3). As an exergame, these playtests indicate a potential of fulfilling the criteria of challenging the players' movement abilities

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(head up and down, stretch to the sides, etc.). The long-term exercising qualities of developing and maintaining movement repertoire are yet to be tested.

#### *Future Development*

The suite of predefined minigames will be expanded, the cards will be further developed into difficulty levels accommodating different levels of bodily abilities, and the objects into single entities. Future development can include expanding the variety of objects or options to connect the various objects for more complex configuration (e.g. light cubes turn on/off laser lines).

### **Discussion and Conclusion**

Analyzing Move Maker gameplay in the theoretical perspectives outlined earlier, the precondition cards create unnecessary and arbitrary obstacles to overcome encouraging player curiosity. The peculiar bodily positions created when the (bodily handicapped) players start to interact with the various kinds of objects in pursuing game objectives, creates a variety of different bodily puzzles to solve. In this situation the players' equilibrium gets reshuffled and creates possibilities for bodily play.

Move Maker is a suite of movement-based games with a potential of challenging the players' movement abilities while at the same time offering a system to explore and develop novel bodily play constructions.

*Interaction in Play - CHI PLAY '15*, ACM Press, <https://doi.org/10.1145/3173574.3173784>

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## Move Maker Design Game:

Before playing, players agree on how to deal the cards, add objects, and the function of the play-thing or another objective to drive the game.

### Dealing the Cards

The cards can be dealt in two ways: Either the dealt cards apply to all players, or to each player only. Maximum two cards can be applied at a time. Agree on when to deal the cards (on turn, on x achievement, etc.).

### Adding Objects

The objects can either be added and replaced on turn, or the players can agree on setting up a playfield before playing.

### Determine the function of the play-thing

As a scoring device (e.g. a ball), a final treasure to conquer (e.g. king in chess), or, leave the play-thing out and create challenges of only bodily preconditions in combination with objects.

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