

Using and facilitating social videogames as warm-ups for embodied design

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Abstract: Warm-ups, as preliminary activities to physical training, are an inherent part of any physical exercise and sports practice. Rooted in the concept of embodied cognition, embodied design is a paradigm that shifts the focus of interaction design from external artefacts and devices to the human body (Svanæs & Barkhuus, 2020). A body-centred design emphasises the importance of having the human body at the centre of the entire design cycle, conveying movement, physical expressivity, feelings, and aesthetics, in a design process that uses the body as both a resource and target. Designing with the body is, therefore, a physically demanding activity that requires a specific set of warm-ups to educate and prepare designers mentally, socially, and physically for the act of embodied design. We propose social videogames as a resourceful framework for creating such a set of warm-up exercises. This paper presents a methodology comprising off-the-shelf commercial videogames whose rules have been adapted for embodied design. Three studies have been executed to validate the game's capacity as warm-up activity and icebreaker for embodied creativity and to study the conditions for an optimal method facilitation to external instructors in preparation for an applied session. The method applied is qualitative and quantitative feedback data gathered from the three studies using questionnaires, tests, observation, and open interviews. The results of the series of studies showed the potential of the proposed methodology as warm-ups for teaching, training, and practising embodied design, as well as giving insights on how to facilitate it. Overall, the game-based warm-ups for embodied design preparation using off-the-shelf movement games have a social and playful nature. The proposed twisted gameplays make them suitable to exert body moves and get ready to think and design with their bodies. The study on facilitation shows the need for a preparation session supported by an experienced person. However, one introductory session is enough for the toolbox to become an easily configurable resource that adapts to the facilitator's needs and goals. We suggest including sample implementation cases along with instruction cards of the embodied games. Further, the warm-up games are customisable using the toolbox's modifier cards.

Keywords: warm-ups, embodied design, social games

1. Introduction

There is a strong connection between social videogames and embodied interaction. Social play requires several players to engage with a game simultaneously, relating to higher inter-player competence and reduced tension and frustration. Existing social games include many examples of alternative controllers that frequently invest in technology-enhanced embodied interaction. Academia has proposed many frameworks from the field of HCI for body-centred interaction design (Turmo Vidal, et al., 2021), as well as the game industry has released many games and platforms that make use of alternative controllers that enable body interaction, such as Nintendo Wii and Switch, Just Dance, PlayStation Move, Microsoft Kinect, etc. Research points out potential unexplored benefits of the body's involvement in play (Canossa, et al., 2020).

We propose that a selection of commercially available social games can be used as a framework for designing and implementing a set of warm-ups for embodied design, described, set-up, and performed to bring embodied design closer to a broader target audience. We proposed modified how-to-play instructions for these games, designed to increase the embodied creativity aspects of the gameplay. This method has been tested in subsequent studies to validate its capacity as warm-up activity and icebreaker for embodied creativity, as well as to study the conditions for an optimal method facilitation (Reidsma, et al., 2022) to external instructors in preparation for an applied session. The paper discusses the results obtained through qualitative and quantitative feedback gathered from all the presented studies using questionnaires, tests, observation, and open interviews.

This research takes place within the scope of the Erasmus+ project MeCaMInD: Method Cards for Movement-based Interaction Design. Therefore, the proposed method's application domain is embodied design, which

aligns with the project's core goal of enhancing a movement-based creative design environment that paves the way towards designing more sustainable movement technologies for people's everyday life.

2. Related Work

Play appropriates the environment where it takes place (Sicart, 2014), relating our bodies to things, places, ideas, and feelings (Ryding & Fritsch, 2020). Existing research points out several benefits associated with games, from surgical preoperative warm-ups (Jalink, et al., 2015) to social icebreaking activities (Depping, et al., 2016), including knowledge acquisition, as well as affective, behaviour change, perceptual and cognitive and physiological outcomes (Boyle, et al., 2016). Social interactions that occur through play lead to genuine bonds, particularly optimal for trust formation. Interpersonal trust is a relevant factor in team performance and efficiency. Groups accept playing ice-breaking games as a viable team-building exercise, with positive effects on group communication in terms of talking activity and group member participation (Depping, et al., 2016), as well as potential benefits in subsequent face-to-face collaborations (Nasir, et al., 2013).

Embodied gameplay can unlock creativity through movement-based exercises and embodiment practices (Ludevig, 2015; Altarriba Bertran, et al., 2020). When comparing the effects of playing the same games with or without different sorts of embodied interfaces (Canossa, et al., 2020; Frommel, et al., 2017; Robinson, et al., 2020), results show that embodied versions enhance social interaction, enjoyment, affection, and an overall better experience. Body-based controllers in games show a strong effect on the participants' experiences, emphasising the aesthetic and further supporting people to feel closer and more connected (Canossa, et al., 2020; Robinson, et al., 2020).

2.1. MeCaMInD

The MeCaMInD (Method Cards for Movement-based Interaction Design) Erasmus+ project strives to make movement-based design methods (MbDM) accessible to a broader audience. We see movement as a vital element in games and play (Erkut & Dahl, 2018) and a key design activity to build awareness of the fleeting and immediate movement experiences (Schleicher, et al., 2017; Marquez-Segura, et al., 2018; Friis & Elbaek, 2017).

Embodied movement is a source of creativity to design technics and the challenges of enabling the right state of body-being (Marquez-Segura, et al., 2018; Schleicher, et al., 2017; Turmo Vidal, et al., 2018). Its exploration requires a designer to facilitate the right mindset and state of a body being by choosing and interconnecting mood setting methods to form an appropriate process and modify it accordingly.

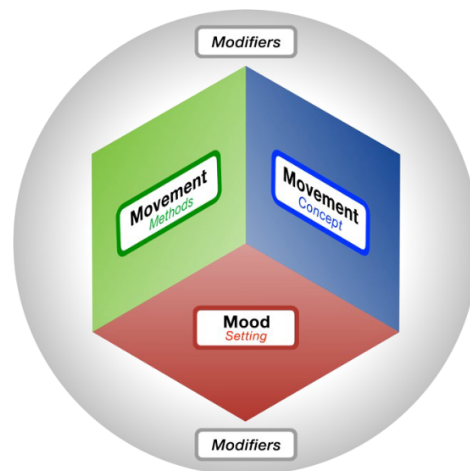


Figure 1. The 4M model with the Mood Setting activities as the foundational part, extracted from (Elbaek, et al., 2022).

MeCaMInD has gathered MbDM into an easy-to-use method card toolbox by making inventories of existing theories and methods, categorised them, and made a model (4M) of four distinct card categories to make the method cards actionable in the field of interaction design (Elbaek, et al., 2022). The 4M model is founded in the theory of embodied cognition 4E, extended, embedded, enactive, embodied and supplemented with the fifth E as emotive (Stilwell & Harman, 2021). The 4M model (Figure 1) illustrates a box placed on top of movement modifiers, which are to be used along with the three other types of movement method cards or as stand-alone cards. This paper introduces and describes the game-based warm-up exercises as part of the mood-setting methods.

3. Proposed method

This section describes the set of designed warm-ups, implemented using commercial videogames whose how-to-play instructions have been adapted to better fit embodied design purposes. Figure 2 shows the front side of the mood-setting cards in MeCaMInD's toolbox that convey each of them.

3.1. Just Dance 2021 for PlayStation 4

Just Dance (Ubisoft, 2022) is a popular multiplatform multiplayer rhythm game series since 2009, where players dance pre-recorded choreographies for a given set of songs by mirroring the moves performed by avatars on the screen, getting rewarded by their timing and accuracy. This project uses the PlayStation 4 version with the PS Move motion sensor controller, up to four players simultaneously.

Players are tasked to play trios and quartets: songs with more than one avatar on screen that challenge each player with different moves and offer punctual physical player interaction in their choreographies. This is as a warm-up activity for players to perform a physical warm-up by mimicking choreographies and relating body movement to physical expressivity. Moreover, since it is a group activity, this also works as a social icebreaker to foster competition by performing accurate and well-timed body movements.

3.2. BUTTON for PC

BUTTON (Copenhagen Game Collective, 2011) is a local multiplayer PC game where up to 8 players compete in a series of physical minigames with changing rules pseudo-randomly picked by the computer. All minigames ask players to take some steps back from the screen to then approach the screen by (or after) following a specific rule to achieve a given goal. Both rules and goals are deliberately ambiguous to a certain extent. I.e., players take 7 steps back, then approach the screen in slow motion, and the winner is the first player to press the A button exactly 3 times on her controller. The computer can't supervise whether players follow the indications, so they are collectively responsible for interpreting and playing by the rules. Winners are awarded medals that accumulate during the session. Completing a minigame takes around 20 seconds.

The adapted gameplay replaces each minigame's rule with quick charades challenge they need to pass as a group before they can continue completing the minigame's goal. Players turn away from the screen. Three of the players pick one card (from a pre-set deck) with a word to be guessed by the fourth player using their body expressions so that no speaking is allowed. Upon a successful guess, all four players turn back to the screen to read the minigame's goal and complete it. Another player takes the role of the guesser before the next minigame starts. Ten minigames are played in a row using this modified gameplay.

Charades adds body movement, creativity, and observation, while still participating in BUTTON's competitive gameplay. It also inserts cooperative gameplay inside the competitive nature of BUTTON, which enriches the social interactions during the gameplay.

3.3. Copy-Dance in 1-2 Switch for Nintendo Switch

Copy-Dance is one in the 28 minigames contained in 1-2 Switch (Nintendo, 2017), a multiplayer party game for Nintendo Switch, where two players face each other while holding the console's Joy-Cons. Copy-Dance asks one player to perform a body pose, then tasks the second player to mirror it as accurately as possible. Scores are calculated according to how well players mimicked the opponent's poses by comparing movement, force, and timing.

For the modified version, a third player constrains body moves by proposing topics for each round (i.e., animals or feelings). This encourages players to be body creative by quickly designing and performing a set of body-moves that express specific concepts.

3.4. Johann Sebastian Joust in Sportsfriends for PlayStation 4:

Sportsfriends (Die Gute Fabrik, 2014) is a compendium of local multiplayer party games available for PC, PlayStation 3 and 4. Among them, Johann Sebastian Joust is a music game with almost no graphics designed for PS Move motion controllers. Players hold a motion controller that is very sensitive to movement. Their goal is to be the last player standing while J.S. Bach's Brandenburg Concertos are being played. When a player's controller is shaken beyond a threshold, the player is out of the game. This can happen either due to a player accidentally shaking her controller too much while moving or after being jostled by another player. When the pace of the background music raises, players are allowed to move quicker temporarily.

The twisted version replaces the goal by tasking players to create a group choreography inspired by the music, traversing their interpersonal space and encouraging them to be body creative while avoiding getting eliminated from the game. Players participate in a sandbox experience for body expression. They experience free movement, both personally and as a team, while interconnected and employing shared gameplay.

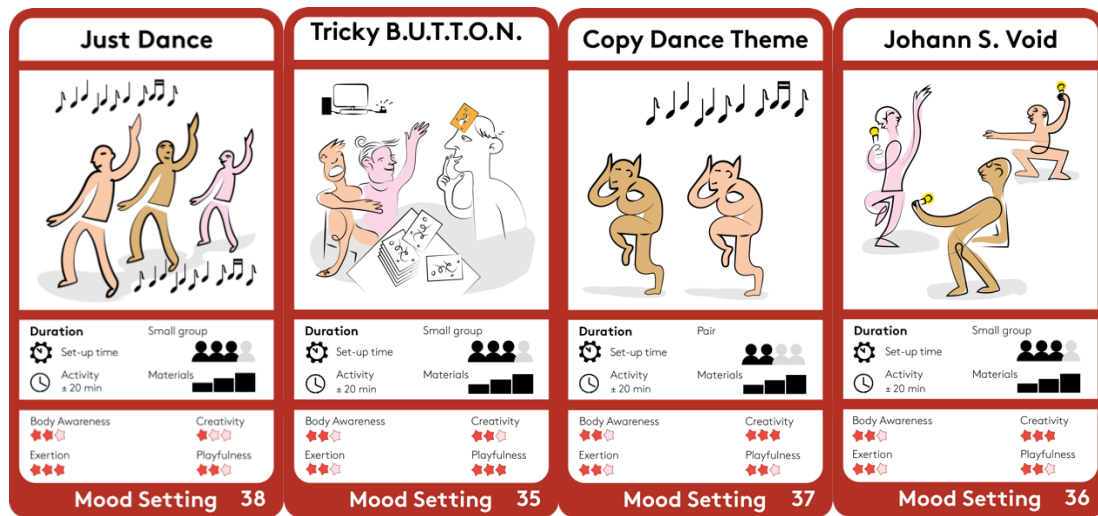


Figure 2. Mood setting cards (front).

4. Study 1: Social Games as warm-ups for embodied design

Study 1 takes place over a three-hour session. Participants first complete a pre-test composed by short exercises to assess their domain-specific creativity, creative self-efficacy, belief in creativity training, and domain-general creativity (Hänninen, et al., 2020). Participants experiment every game-based warm-up and fill out a post-test questionnaire.

A chairperson introduces participants to the games and solves gameplay-related or technical questions. Two observers take notes of the participants' performance. Verbal informed consent is obtained from the participants, and it is made clear to them that they can withdraw from the study at any moment.

Domain-specific creativity	
Pre-test	Post-test
Surströmming ("sour herring") is a lightly-salted fermented Baltic Sea herring traditional to Swedish cuisine since at least the 16th century. The fermentation process takes at least six months, and it is well known as one of the most putrid food smells in the world. Give as many creative ideas to motivate people to consume it. You have 10 minutes to do this.	Saltlakrits (salty liquorice) is a variety of liquorice flavoured with ammonium chloride, and it is very popular in Sweden as well as in the Nordic countries. It gives salty liquorice an astringent, salty taste, which adds bitterness to the flavour and leaves a dry and sharp taste on the tongue. Give as many creative ideas to motivate people to consume it. You have 10 minutes to do this.
Domain-general creativity	
Pre-test	Post-test
What is blue? Try to list as many different ideas in 2 minutes.	What is red? Try to list as many different ideas in 2 minutes.
Creative Self-efficacy and Belief in Creativity Training.	
Likert-scale questions from "Strongly disagree" to "Strongly agree", included in both pre- and post- tests.	
I feel that I am good at generating novel ideas.	
I have confidence in my ability to solve problems creatively.	
I believe that I can help others to further develop their ideas.	

I believe my creativity will advance by deliberately practicing and exercising my creativity.
I believe my creativity will advance through playing games that make me move and interact with others.

Table 1. Questions were included in the individual pre-and post-tests. Except for the Likert-scale questions, the left and right columns show the pre-and post-test questions, respectively.

Pre- and post-tests are composed by the questions in **Table 1**, answered individually and anonymously, inspired by the experiments in creativity testing by Hänninen et al. (2020). Participants are then asked to participate in a group exercise described in Table 2. Two judges evaluate all answers independently, scoring them from 1 to 5 in four categories: originality, fluency, flexibility, and elaboration. This allows us to evaluate features in the proposed answers and the participants' performance while representing them.

Domain-general creativity	
Pre-test	Post-test
Participants are given several coloured hoola hoop rings. They're given 10 minutes to propose and discuss in groups as many non-conventional uses for them as they can imagine. After this time, participants are asked to perform all of them.	Participants are given several coloured dance scarves. They're given 10 minutes to propose and discuss in groups as many non-conventional uses for them as they can imagine. After this time, participants are asked to perform all of them.

Table 2 Exercises included in the group pre- and post-tests.

4.1. Results from Study 1

The study was participated by 22 bachelor and master students with different backgrounds in game development, education, and sports sciences. A comparative analysis was made to detect differences in the participants' responses before and after playing the proposed game-based methods.

We have performed a content analysis on the answers to both pre-and post-questionnaires. The answers to domain-general and domain-specific creativity questions have been analysed to quantify word frequency and identify relevant subjects and concepts. The answers to the questions about creative self-efficacy and belief in creativity training have been ranked by their Likert-scale score. The solutions presented to the domain-general creativity exercise have been quantified according to their assigned originality, fluency, flexibility, and elaboration scores. This analysis has been contrasted with the observer notes on the participants' performance in the game-based experiences.

For the domain-specific question, participants were noticeably more eloquent during the post-test, with an increase of 20.12% and 46.66% in words and sentences, respectively, in their answers. There were 3 empty answers in the pre-test, whereas all participants responded in the post-questionnaire. Answers in both pre-and post-tests relate to one of the following topics: "disguise taste", "make a challenge/game", "nutrition facts", and "one-in-a-lifetime experience". Another category of answers was only found during the post-test: "Offer a reward". Similarly, the responses to the domain-general question contained up to 15,78% more words in the post-test. The answers to the questions in creative self-efficacy and belief in creativity training showed almost the same distribution of Likert scores in all questions on both occasions.

Participants showed increased overall performance in the post-test group domain-general exercise with 24 different uses with an average aggregated score of 7.91 in the post-test (20% and 20,76% increase from the pre-test, respectively). The category that the experiment showed the highest increase (25%) was originality. No uses in the pre-test scored higher than 9 in total, whereas 6 uses in the post-test scored at least 10, being 18 the highest aggregated score.

4.2. Discussion

Study 1 analyses the capacity of the proposed methods to get participants ready for embodied creativity, supporting them in getting into the right mindset to later engage in embodied and movement-based activities. It doesn't aim to analyse participant performance at exerting creativity but focuses on whether participants' readiness to exercise their body-creativity increases after the proposed warm-up session.

Results show that participants' answers were more diverse after the exercises under the same conditions and time limit. The domain-general group exercise showed that participants' readiness to design, act, and perform

with their bodies was higher after playing social videogames. On the contrary, participants' perceptions of their creative skills remained unchanged after the experimentation.

The observations were taken during the session point that the participants engaged smoothly with the proposed team activities, despite having a cold start with no previous exercises or preparation. A relaxed and fun environment invited participants to socialise and motivated their curiosity to enjoy the exercises, cooperating and competing where appropriate. These are desirable characteristics of warm-up and ice-breaking activities.

5. Studies 2 and 3: Facilitating the game-based methodology

Studies 2 and 3 aim to understand how external instructors could better facilitate the proposed method. To these aims, the experimental setting now adds the role of facilitators to the existing roles of participants, observers, and chairperson. In both studies, a group of students are invited to participate in a single session like the one in the first study, though in this case, the students are taking a course in which they are tasked with an embodied design assignment. The course lecturers participate in the session as facilitators, becoming the test subjects. The session has been arranged to serve the students as a warm-up session to prepare them for their embodied design assignment.

5.1. Study 2: Facilitation without previous training

The session lasted for 5 hours, with a total of 29 students in Interaction Design as participants, and three teachers as facilitators, experts in teaching embodied and interaction design. As in the previous case, the study counts on a chairperson and two observers. Verbal informed consent was obtained from the participants, who could withdraw at any moment.

Participants arrived at the session without any prior instructions or information about the game-based experiences. Both facilitators had been verbally informed about the methodology and the composing games in a short meeting before the session. Still, they hadn't tried any of the experiences themselves and declared not to have previous experience with the included games. The session used the four experiences, which were illustrated by their accompanying mood-setting cards (Figure 2), made available for the facilitators to use at their own discretion.

Facilitators were asked to fill out an online post-questionnaire (Font & Johnsson, last accessed May 2023) to obtain qualitative data from experts when facilitating the methodology during a session integrated into a course, but without receiving any prior training about it.

5.2. Results from Study 2

We have performed a content analysis on the answers to the questionnaire to extract the most relevant and frequently repeated concepts and topics. This has been matched with the observation notes taken during the experiment, to determine when concepts were noticed from either one or both ends (participant and observer).

Facilitators agreed on that the proposed method can't be used without previous preparation. They asked the chairperson several times for help, both with technical questions about how to operate the games and understanding the modified gameplays. This matches the notes from the observers. Their perceptions on the participants highlight that students had to invest some time at the beginning into understanding some of the modified gameplays, which took some time from them before they started engaging fluently in the group dynamics. However, facilitators and observers noted that all participants enjoyed all activities both socially and individually.

Facilitators perceived that the method gave participants a playful framework to temporarily get away from their assignment to experiment with embodied design ideas freely. They positively valued the competition and passion elicited by the social gameplay, as well as how it let them carelessly inhibit any social pressure or prejudice to be able to feel comfortable while exposing their body movements.

Facilitators and students initially consulted the method cards, but both soon discouraged them and remained unused during the session. It was noted that the cards demand time and concentration to be read through and understood, whereas the session is unsuitable for focused reading.

The method was deemed very suitable to become part of an educational setting as a warm-up activity for courses focusing on innovation, interaction design, and bodystorming. The main noted advantages of such a scenario were students gaining insights on their current course learning, the opportunity for the students to

switch to an explorative context where they experiment with their body creativity, and a framework where social interactions are fostered to favour student teambuilding.

5.3. Study 3: Facilitation after previous training and planning

This third study was motivated by the takeaways from study 2 regarding lack of previous preparation. The experimental setup was modified to address this issue, adding two previous meetings where two facilitators (who already participated in study 2) had the chance to use materials in the MeCaMInD toolbox to discuss and design the composition of the experimental session. The materials used were the four method cards used in study 2 (Figure 2), plus the complete set of modifier cards available in the toolbox (Figure 3). Having in mind their knowledge about the four game-based experiences and the cards, the facilitators first filtered out the modifiers that didn't suit the game-based mood-setters, to then design a session with only two of the available games (Copy Dance and Johann Sebastian Joust), and two sets of modifiers tailored to each of them. They planned to have the session as part of a master course, as a training session for one of the course projects.



Figure 3. Sample modifier cards (8 out of 284) belonging to 8 different categories (among 16 available).

The session lasted two hours, with 8 master students as participants, two facilitators, one observer and a chairperson. The facilitators were instructed that the chairperson would only mediate to solve technical issues with the involved materials but wouldn't intervene to give methodological support. After the participants played the two selected games during the first hour, an open interview was conducted during the second half of the session. Both facilitators were asked to complete an online post-questionnaire (Font & Johnsson, last accessed May 2023). The video was recorded during the whole session, and written informed consent was obtained from all participants.

5.4. Results from Study 3

Like Study 2, we performed a content analysis on the answers to the questionnaire and matched the extracted concepts with the observation notes. Additionally, a two-fold analysis has been performed in the recorded video. The first half of the video, related to participation in the game-based experiences, was analysed to identify patterns in how facilitation was carried out and how participants performed in the experiences. A narrative analysis has been performed on the second half of the video, on the open interview, to extract results on how relevant concepts were perceived from the perspectives of both facilitators and participants.

Answers confirmed that this time, the facilitators knew enough about the toolbox's resources to properly organise the session and integrate it as part of the course. This experimental setup allowed us to get insights from the facilitators on the cards, which were deemed comprehensive and interesting to explore embodied interaction. It was suggested that having sample implementation cases for inspirational purposes on using the cards would be an interesting additional resource.

The facilitators' answers to the game-based experiences were much more detailed in this case, with specific insights on each game and their expected outcome in combination with several modifier cards. Mood-setting cards were deemed useful only during the preparation session. In contrast, modifiers were used both for preparation and during the experimentation as a resource for facilitators to add variety to the gameplay as the session progresses dynamically. Other props available in the room, like furniture, were punctually added by the facilitators to foster participants' awareness of their body movements. This denotes a higher degree of

familiarity with the methodology that allowed facilitators to experiment fluently with other available resources at their own will.

Facilitators started both game experiences by showcasing how to play in the standard and modified gameplays. No major issues were reported, and the chairperson only intervened once when one participant accidentally exited a game to the main menu.

Participant engagement was reported in high grade, as in the former study, though now students asked for feedback on their body moves and expressions, actively reflecting and discussing on what they intended and eventually communicating with them. One facilitator noted that some participants were too focused on playing the activity as intended to the detriment of a playful environment where students could freely experiment with their creativity.

5.5. Discussion

Studies 2 and 3 suggest that the proposed methodology can't be expected to be handled by facilitators by a straight out-of-the-box approach. Without proper preparation, participants seem to engage well with the proposed games, which easily elicit a relaxed and playful environment to break the ice and invite participants to perform body movements. Nevertheless, neither facilitators nor learners can be expected to be familiar enough with the materials used for the experience to be fruitful as a warm-up for embodied design. Results show that the optimal minimal configuration requires one person with experience in MeCaMInD's toolbox to guide the facilitator during the first contact with the proposed method and games, followed by a discussion where the facilitator is assessed on how to integrate it as part of an extended learning activity with the support of the mood setting and modifier cards. Results from Study 3 show that a whole session can be run entirely by a facilitator without the need for a chairperson. They also suggest that MeCaMInD's toolbox works well as a resource for planning, adapting, and integrating the methodology as part of a course or assignment.

6. Conclusions and Future Work

This paper proposes a game-based methodology as warm-ups for embodied design, using off-the-shelf materials commonly available at stores. The social and playful nature of these games makes the proposed method reach out to a very broad set of users, who can easily become familiar with and engage well with the group activities regardless of their background. The proposed twisted gameplays make them suitable to exert body moves and get ready to think and design with their bodies.

The studies on facilitation pointed out the need for a preparation session supported by someone with previous experience using MeCaMInD's toolbox. Nevertheless, results show that one introductory session is enough for the toolbox to become an easily configurable resource that adapts to the facilitator's needs and goals, highly customisable with the use of the modifier cards and inviting to extend it with extra props.

Results from Study 1 show that using games as warm-ups for embodied design is promising. Still, this approach needs to be validated at larger scales as a recurrent instrument in extended periods of time (i.e., a repeated activity throughout a course), allowing separate pre-and post-tests to eliminate any potential influence on one another. Extended studies will also allow us to evaluate these contributions in combination with the method and concept cards in MeCaMInD and different application domains.

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