

Developing Ideation Cards for Mixed Reality Game Design

Richard Wetzel, Tom Rodden, Steve Benford

The Mixed Reality Lab
University of Nottingham
Jubilee Campus, Nottingham NG8 1BB, United Kingdom
{richard.wetzel, tom.rodgen, steve.benford}@nottingham.ac.uk

ABSTRACT

Mixed reality games (MRGs) pose new challenges but also opportunities to designers. In order to make the design space of MRGs easily accessible and enable collaborative design in a playful manner we have developed *Mixed Reality Game Cards*. These ideation cards synthesize design knowledge about MRGs and are inspired by a variety of other successful ideation cards. We describe six studies, illustrate the iterative development of our cards, and reflect how the structure of our cards might influence future ideation cards.

Keywords

ideation cards, game design, mixed reality games, pervasive games, location-based games

INTRODUCTION

Mixed reality games (MRGs) differ from traditional videogames by combining digital elements with the real world environment. Smartphones equipped with GPS or NFC provide new forms of interactions. MRGs are often played outdoors and turn the players into their own avatars – interacting with the game world by walking or running and engaging with real world locations or objects. They include (or overlap with) other similar categories of games like location-based games, pervasive games, or augmented reality games. *GeoCaching* (O’Hara 2008) and *Ingress* (Niantic Labs 2012) are two MRGs that have reached a large audience, whereas *Can You See Me Now?* (Benford et al. 2006), *REXplorer* (Ballagas et al. 2008) or *Feeding Yoshi* (Bell et al. 2006) showcase games driven by academic research activities.

As a relatively new form of gaming, the reflection about and analysis of MRGs is still mostly limited to academic publications, e.g. (Montola et al. 2009) or (Davidsson et al. 2004). Designing such games however is not only difficult because of the rich design space MRGs offer, but also because these games raise significant new challenges. Digital content and game play needs to be embedded into real-world settings. Local conditions such as weather or traffic have to be taken into account. Spectators or bystanders might interfere or influence the game. Technologies like GPS and mobile data connectivity are unreliable and often imprecise or faulty. Other recurring themes that are relevant for MRG design include seamfulness (Chalmers and Galani 2004), city-wide performances (Benford et al. 2004), emergent behavior (Lund et al. 2010), or in-situ authoring (Weal et al. 2006).

Proceedings of 1st International Joint Conference of DiGRA and FDG

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Furthermore MRGs are also often developed as part of interdisciplinary teams. Technology experts might know the ins and outs of how to utilize sensors. Game designers combine mechanics to create the gameplay experience. Content or location experts provide the necessary context for shaping a game around a specific place and can contribute atmosphere and theme. However, these parties do not necessarily have the same interpretation of the design space or may even be severely limited in their knowledge.

Having come across these issues repeatedly during the course of our research activities, we decided to tackle this problem by developing a deck of ideation cards specific for mixed reality games. Ideation cards offer a playful way to engage with design tasks, and have been used successfully in a wide variety of domains.

Our *Mixed Reality Game Cards* introduce designers to mixed reality games in general and more specifically invite them to design games in collaborative and playful design exercises. The cards utilize rules and formats that are inspired by other ideation card decks and combine two different approaches to support initial idea generation as well as more in-depth development of this idea. In this paper we describe the iterative design process of creating these cards over the course of six studies. Our evaluations furthermore allow us to not only reflect on our own deck of ideation cards but also to provide valuable insight for the design of ideation cards in general.

IDEATION CARDS

The physical properties of ideation cards makes them resemble card games, and they can be classified as design games (Brandt and Messeter 2004) (Halskov and Dalsgaard 2006). Ideation cards possess game-like rules ranging from the way they structure card draws, turn-taking, playing and discarding cards to randomly revealing them. They enable collaborative design in a playful atmosphere. Cards are used as orienting devices, conversation starters, and pace-makers (Hornecker 2010).

By now ideation cards are a viable design method utilized by professional designers. The *IDEO Method Cards* (IDEO 2002) are a collection of design methods that can be used as part of a design process. The *IDEO Method Cards* are context agnostic – they are not created to help with a specific topic but provide tools for any design scenario. *Method Kit* (Möller 2012) on the other hand is not a single card deck but a collection of specific decks that cover different topics and provide themes and concepts for structuring brainstorming sessions. These two ideation decks have one interesting commonality: The cards are used as conversation starter around a specific topic. They do not themselves become an element of the design. In that regard they are similar to the *Deck of Lenses* (Schell 2008). The author describes 113 lenses to look through when designing a game. These lenses have been translated into a deck of ideation cards. Each card (lens) asks questions of the designer and encourages thinking about different and important aspects of their design in order for them to gain a better understanding of it. This is very similar to the approach the *Exertion Cards* are following (Mueller et al. 2014). Each card contains a thought-provoking suggestion and covers different elements that are crucial for exergames. When looking at these cards we can argue that they might be better suited for designers that already have a preconceived idea – they do not necessarily support the initial step of creating an idea in the first place.

A good example of a deck that supports idea creation are *PLEX Cards* (Lucero and Arrasvuori 2010). This deck consists of 22 cards that help users to create playful experiences. Each card describes a concept, e.g. *Nurture*, *Fantasy*, *Sensation*, *Submission*, *Thrill*, or *Discovery*. In *PLEX Brainstorming* a card is randomly selected while each of the

two designers draws three cards. One designer starts exploring an idea based on the first card. The second designer can then choose one of their cards and extend the idea that way. Finally, the first designer does the same to finalize the idea. In *PLEX Scenario* designers draw three random cards and assign them as *Beginning*, *Continuation*, and *The End*, developing an idea based on these cards while doing so. *VNA* cards (Kultima et al. 2008) are another example for a card-based design game. Similar to *PLEX* they are used to create initial game design ideas. The *VNA* cards consist of three different categories that give the deck its name: red *Verbs*, blue *Nouns* and orange *Adjectives*. Each of these cards contains exactly one word. *Verbs* can be *design*, *bounce*, *grow*, *devote*, *write*, or *fill*. *Nouns* include *keys*, *fugitive*, *creature*, *estate*, *frosting*, or *flower*. Examples for *Adjectives* are *empty*, *quite*, *steely*, *musical*, *rolling*, or *high*. The whole deck consists of 240 cards with 80 cards for each category. In order to use *VNA* a first designer draws a random *Verb* and describes how this could be basic idea for a game. The next person draws a *Noun* and tries to extend the existing idea. This is repeated a third time: an *Adjective* is used to finalize the game idea. This way *VNA* is used to rapidly generate several ideas for games that can then be further developed at a later stage.

Looking at the described ideation cards we can see that while their overall goal is largely identical (supporting the design process), each deck approaches it a different way. Examples for distinguishing elements are the amount of content, the specificity of the content, the rules for interacting with the cards, and whether the cards are more aimed at creating an initial idea or want to help explore a perhaps already existing idea. Our research focus therefore became how to best adapt these established best practices as part of our own deck. To this end we identified the following goals for our *Mixed Reality Game Cards*:

- Encapsulate domain-specific design knowledge
- Foster collaboration between (multidisciplinary) teams of designers
- Not overwhelm (inexperienced) designers
- Not make (experienced) designers feel restricted
- Support initial generation of ideas
- Support more in-depth reflection of ideas

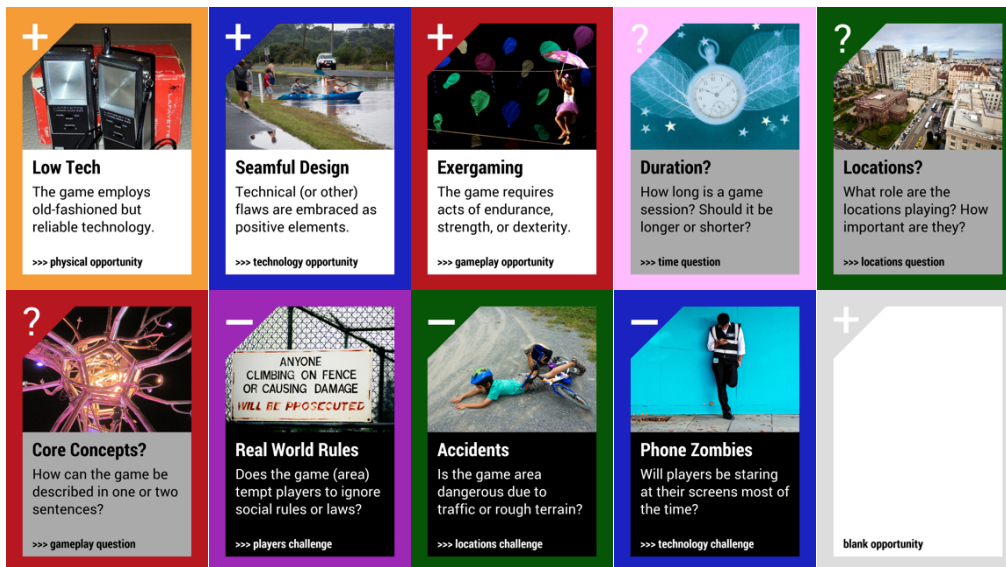


Figure 1: Examples for *Opportunity*, *Question*, *Challenge* Cards, and a blank card.

MIXED REALITY GAME CARDS

We developed the *Mixed Reality Game Cards* iteratively over the course of several studies. Our cards consist of three rather distinct types of cards: *Opportunities*, *Questions*, and *Challenges*. Each type has a specific function in the overall ideation process. Such a division is unusual for ideation cards - in the related work section we have seen that all other ideation cards use the same type of card. We introduced these different types to combine two different and common usages for ideation cards: creation of an initial idea (e.g. *VNA*, *PLEX*) or reflection on an idea (e.g. *Deck of Lenses*, *Exertion Cards*).

Opportunity Cards describe a single concept, mechanic, or element of a mixed reality game. In an ideation session, these cards can be selected and combined to create a game design idea. They are the building blocks that describe a game. *Question Cards* require users to answer questions in order to further define their game design idea. After an initial game design idea has been conceived they then help users to turn their (potentially) still rough ideas into more concrete ones. Some of them are generic and could be relevant for any type of game, while others are specifically important for mixed reality games. *Challenge Cards* are the third type of card. These describe common issues and pitfalls that can negatively affect mixed reality games. Users are encouraged to “proof” their game design ideas against these cards to see if any of the described problems might occur and if so how they could be prevented. The full deck of cards consists of 51 *Opportunities*, 18 *Questions*, and 24 *Challenges* (93 cards in total). Example cards can be seen in Figure 1 whereas Table 1 gives an overview of all cards.

The graphical layout of all cards is identical. The upper left corner denotes the type of card (+, ?, -) which is further supported by using text on white background for *Opportunities*, grey background for *Questions*, and black for *Challenges*. In addition the type of card is written at the bottom of the card. Apart from a type, each card also belongs to a category. The categories are *audio*, *gameplay*, *locations*, *management*, *physical*, *players*, *sensors*, *technology*, and *time*. The category is written next to the type on each card. The category also defines the border color of each card. The actual content of a card consists of three parts. A photo takes up the upper half, followed by a title and a three-line description. The back of the cards does not contain any content and just displays the type to make sorting easier. All cards have typical playing card size dimensions: 64 x 89mm (2.5 × 3.5 inches).

For deriving the content for the cards we used several methods. A lot of card content was derived from our personal experiences in developing mixed reality games over several years as researchers. Other cards were created based on related work about specific mixed reality games or mixed reality game design in general (e.g. sources cited in the introduction of this paper). Lastly, observations and feedback from each study also fed back into the card deck. We do not claim that the deck is necessarily complete, however we believe that it covers a large and diverse area of the design space. The deck also includes blank cards of each type to allow designers to extend the cards with their own *Opportunities*, *Questions* and *Challenges*.

THE RULES

Using the *Mixed Reality Game Cards* can be roughly divided into three stages:

- idea generation (coming up with initial ideas)
- idea development (evolving an idea)
- idea documentation (archiving the final state of the idea).

Based on our experiences sessions with 3 to 4 designers work best, especially if they come from different backgrounds. In general it is a good idea to sit around a table that is large enough to move cards around and form contextual groups with them on the fly, but it should also not be so big that not all designers can easily reach the cards. Pens, paper, post-its etc. are valuable additions to any design session and the Mixed Reality Game Cards are no exception. For all the processes it is important to note that the designers are free to interpret any card however they like. They can focus on the title, a word from the description, and/or any detail on the image or what they associate it with. There is no “wrong” interpretation of a card.

Category	Opportunity	Question	Challenge
audio (yellow)	COMPELLING AUDIO, MOBILE SOUNDTRACK		NOISE
gameplay (red)	AREA CONTROL, COLLECTING, CREATIVITY, EXERGAMING, EXPLORATION, MINI GAMES, PERFORMATIVE PLAY, RIDDLES, SCAVENGER HUNT, STRONG NARRATIVE	BEGINNING AND END?, CHALLENGING?, CORE CONCEPTS?, EXPERIENCE FLOW?, FUN AND JOY?, MAIN MECHANIC?, THEME AND STORY?	FEATURE CREEP, UNINTENDED RACE
locations (green)	FITTING LOCATIONS, GENERATED LOCATIONS, HEADQUARTER, SUBVERTED LOCATIONS, UNUSUAL LOCATIONS	INDOOR OR OUTDOOR?, LOCATIONS?, SIZE OF AREA?	ACCIDENTS, BLAND LOCATIONS, DISRUPTION, DYNAMIC PLACES, GETTING LOST, LONG DISTANCES, OVERCROWDING, RELOCATION
management (brown)	OPEN AUTHORIZING, PUPPET MASTERS	OBSERVING PLAYERS?	TESTING
physical (orange)	ACTORS, LOW TECH ,SET CONSTRUCTION, TECHNICAL ARTIFACTS, USEFUL PROPS, VEHICLES, WEATHER INPUT	NOTHING PHYSICAL?	RAIN AND SNOW, SUNSHINE
players (purple)	ALTERNATE REALITY, COLLABORATION, COSTUMES, DIFFERENT ROLES, ONLINE PARTICIPATION, ROLEPLAYING, SOCIAL CONTRACT, WORLDWIDE	NUMBER OF PLAYERS?, TARGET GROUP?	CRITICAL MASS, REAL WORLD RULES, UNCLEAR INSTRUCTIONS
sensors (turquoise)	MANUAL INTERACTION, MOTION TRACKING, PASSIVE TRACKING, PHYSIOLOGICAL DATA, PUBLIC INFRASTRUCTURE, STATIONARY SENSORS, WIZARD OF OZ	SUITABLE SENSORS?	INACCURATE SENSORS
technology (blue)	AUGMENTED REALITY, GLOBAL GAMESTATE, PEER-TO-PEER, PUBLIC DISPLAY, SEAMFUL DESIGN, TELEPHONY, TERMINALS	GAME SERVER?, NOTHING DIGITAL?	BATTERY LIFE, CONFUSING INTERFACE, GIMMICKY TECH, PHONE ZOMBIES, UNENGAGING AR, UNSTABLE CONNECTIVITY
time (pink)	EPISODIC CONTENT, TIME PRESSURE, TIMED EVENTS	DURATION?	

Table 1: Overview of all Mixed Reality Game Cards.

Idea generation

Idea generation is the first phase of the design process. The goal is to generate several simple but intriguing game ideas in a short amount of time. In order to facilitate this use case we combine the *Opportunity Cards* with something we call *Theme Cards*. These are cards that serve as an additional source for inspiration without any connection to mixed reality games. We suggest using surreal and/or detail-rich images and recommend repurposing cards from the board game *Dixit* (Roubira 2008); Figure 2. We propose two methods that are reminiscent of *PLEX Brainstorming* and *PLEX Scenario*

Variant 1. Each designer draws three *Opportunity Cards*. A randomly chosen *Theme Card* is revealed in the center of the table. One designer places one of their cards openly next to the *Theme Card* and describes how the two cards combine into a game idea. All designers are encouraged to discuss the proposed idea together. Then the other designers do the same and play one card into the communal area, further extending the game idea. They can either do this in turn-order or depending on who has “the best” card. When as many *Opportunity Cards* have been played as designers are participating, the final step is to agree on a game idea to write down.

Variant 2. The designers reveal three random *Opportunity Cards* and a *Theme Card* in the center of the table at the same time. They then jointly discuss how all four cards can be combined into one game idea – they are not allowed to ignore any of the cards. It is a good idea to enforce a time limit of around five minutes to ensure the group does not lose focus. Like in the other variant, designers are encouraged to write down their game idea.

Idea development

Designers that started with idea generation can choose one of those ideas to further develop. If they already had a specific idea in mind they can also start straight with this stage. During idea development the designers get to use all types of cards. They start with the *Opportunity Cards* to further flesh out their game design idea. This time they are not restricted by a card limit, and they are also encouraged to remove any cards from the table that no longer represent the game idea. In order to do so the designers draw three cards each, and then play or discard cards depending on whether they enhance the design. Designers can also draw new cards at any time or fish out a specific card if they think it is especially relevant. When they have worked on their idea in this way for a while, they can decide to continue with the next step and introduce the *Question Cards*. The *Opportunity Cards* stay on the table, representing the current state of the idea. However they now draw *Question Cards* and play them as triggers for a discussion if they believe they are helpful or crucial for their design. The *Question Cards* should help the designers to ground their idea and turn it into something more concrete. When the designers feel they have covered the important aspects they move on to the final step. The *Challenge Cards* are used in the same manner as the other two types of cards. This time however the game idea is “proofed”. The cards serve as prompts to evaluate if there are any obvious (or non-obvious) flaws or holes in the design.

Each of these steps of the idea development stage typically lasts about 30 minutes. Designers can of course extend or shorten this duration based on the overall flow of this stage. Likewise they might want to go back and forth between the different steps. This is typically the case when *Question* or *Challenge Cards* change the designer’s perception of the game idea; adding or removing *Opportunity Cards* lets them change the representation of the idea.

Idea documentation

The last stage of interacting with the cards is to document the final state of the idea. Designers from our studies usually found it helpful to arrange the important cards from the previous stage in a meaningful way (e.g. by forming conceptual groups). This can be done on the table itself, on a large sheet of paper, or a white board. If the cards are annotated and connections are drawn between them they serve as a useful visual reminder of the overall game design idea (as seen in Figure 3). This should ideally not be limited to just *Opportunity Cards* but also include *Questions* and *Challenges* that were heavily discussed or were crucial for design decisions. Likewise cards that do no longer seem important should be removed to streamline the idea. This documentation stage makes sure all designers have the same understanding of the game idea (and therefore more often than not will spark additional discussions).

FIRST SERIES OF STUDIES

When we performed our first studies the card deck consisted of 69 different cards: 36 *Opportunity Cards*, 13 *Question Cards*, and 20 *Challenge Cards*. These cards were much more text heavy than the final iteration: Cards contained examples and additional explanations (see Figure 2). Due to being the very initial version, the graphic design was also less sophisticated. Here our focus was to gain a general understanding on how the cards work together, the impressions that participants get from them, and what obvious areas of improvement are. To this end we conducted a total of three studies with different types of participants and slightly different approaches to the structure of the studies. We have summarized these studies in Table 2.

Study 1.1	15 bachelor students of games computing participated in this study. It was conducted as part of a two-week voluntary non-graded module on mixed reality game development. Students formed four groups of three to five participants each and utilized the cards in a total of three sessions of 25 minutes (idea generation), and 45 and 25 minutes (idea development). Data collected: notes, photos, videos, questionnaires.
Study 1.2	As part of a research project we ran a study with 25 project members consisting of professionals and academics that were divided into groups of five participants. Each group had already developed initial game ideas, and they used the cards to further explore their designs. The groups had one hour for idea development and idea documentation. Data collected: notes, photos, questionnaires, posters.
Study 1.3	We also wanted to trial the cards with a group of inexperienced users and got this opportunity at a writer's festival. Two groups of five writers, authors and publishers participated in this study. As an experiment we skipped the first stage and let them work in idea development for 45 minutes. Data collected: notes, photos, videos, questionnaires, interviews.

Table 2: Overview of studies conducted during iteration 1.

In general the cards were well received by the participants of the different workshops. They were deemed as helpful for brainstorming and fun to interact with. The collected quantitative data from the first three studies (Table 3) supports this impression. In open-ended questions we gave participants the ability to point out which aspects they liked and disliked. Each quote is attributed to a study and a participant in parentheses. Cards were praised for simplifying brainstorming, breaking the ice, being easily accessible, sparking creativity, and lowering the barrier for proposing ideas.

“It simplifies brainstorming and makes it more fun” (1.1-P5)

“They allowed for good brainstorming and discussion without having to spend lots of time coming up with ideas from scratch. They helped provide a framework to build ideas off of.” (1.1-P11)

“Help create discussion. Help to break the ice.” (1.2-P3)

“Makes it easy to discuss in a new way” (1.2-P15)

“All the members of the group were able to participate and add to the brainstorming” (1.2-P20)

“It was the interaction of our creative minds that was fun - the cards were the tool to enable this.” (1.3-P9)

“It's easier to present ideas. **It's not personal when you reject an idea.**” (1.1-P10)

The main negative points concerning the cards were the graphic design (unsurprisingly) and the amount of text that was depicted on them.

“I understand the cards are in the development phase - so the visual appearance will be improved” (1.2-P20)

“Could have a nicer design to be friendlier to the eye.” (1.1-P3)

“Overload of information.” (UL1.1-P2)

“It took some members a re-read to fully take in the meaning of the card.” (UL1.3-P9)

“Less information might improve interpreting the cards” (MAG-P10)

“After playing the card, everybody needed some time to read it.” (MAG-P8)

“Hard to read when they were upside down” (BWF-P4)

Study	Question	1	2	3	4	5	AM	SD	n
1.1	The cards were very helpful for brainstorming.	0%	8%	25%	33%	33%	3.92	0.95	12
1.1	I enjoyed using the cards.	0%	0%	25%	33%	42%	4.17	0.8	12
1.2	It was fun using the cards.	4%	0%	13%	33%	50%	4.25	0.97	24
1.2	The <i>Opportunity Cards</i> were useful for brainstorming.	0%	4%	21%	29%	46%	4.17	0.90	24
1.2	The <i>Question Cards</i> were useful for brainstorming.	0%	0%	17%	33%	50%	4.33	0.75	24
1.2	The <i>Challenge Cards</i> were useful for brainstorming.	0%	0%	13%	42%	46%	4.33	0.69	24
1.3	Interacting with the cards was fun.	10%	0%	30%	40%	20%	3.6	1.17	10

Table 3: Questionnaire data from studies 1.1, 1.2 and 1.3. (1 = “I don’t agree”; 5 = “I agree”; AM = arithmetic mean; SD = standard deviation; n = number of participants)

In addition to these general observations we also noticed a potential weakness in the idea generation stage. Participants of the first study were following variant 1 (selecting a card from their hand to play). While this worked well for them and they created a variety of interesting ideas, we also noticed a tendency to play a card that “*fit*” with the others. In one instance for example a participant had played DOMINANT AUDIO as the first card. Another participant then wanted to add LARGE AR to the game idea. Playing the card however was met with strong protests from the other two group members who thought such a combination “*does not make sense*”. After a short argument, the participant withdrew the card and instead played a card that was seemingly more compatible, PEER-TO-PEER. We believe the barrier to play a somewhat matching card is lower than to play one that contradicts the current idea in some ways. Our (subjective) impression was that this behaviour led to less daring ideas overall.

As an experiment we skipped the initial idea generation stage with the participants from study 1.3. We wanted to see how an unrestricted brainstorming would develop. In both instances participants were building seemingly elaborate ideas consisting of many cards.

When playing a card a participant would introduce it with “I think this fits really well” or “I think we should also have this element”. Instead of fleshing-out an existing idea it however had the opposite effect and diluted it. During the reflection after the session the participants mentioned this aspect of the design process: “*I found the cards *very* helpful as a brainstorming exercise, but moving past the purse of ideas into a more concrete concept proved difficult.*” Another one had a similar view: “*The cards gave the conversation direction, but at random. I found myself getting lost, as each group member was stringing together very different thought patterns, in constant flux.*” Finally, a third participant phrases it more drastically: “*They encouraged us to speak in hypotheticals. They created bland, uninspired ideas.*” In both cases the introduction of the Question Cards seemed to work however: The participants started to reign in their idea and rediscovered the original core of it.

SECOND SERIES OF STUDIES

For the next phase of studies we created a new iteration of the cards: 44 *Opportunity Cards*, 17 *Question Cards*, and 21 *Challenge Cards* made up a deck of 82 cards. Based on the experiences with the previous iteration we drastically reduced the amount of text on the cards and improved the graphic design (see Figure 2). At this stage of the development of our cards we wanted to go deeper into the phenomena that we had witnessed. We were especially interested in more thorough feedback concerning the split into the three different types of cards. We also wanted to find solutions for the observed problems concerning the initial idea generation step and explored different methods to improve this phase. The studies are summarized in Table 4. Unlike in the previous section we will discuss the study results separately from each other to provide better insights into the peculiarities of each one.

Study 2.1	We ran this study as part of a two-day game jam event with professionals, academics and artists that all shared an interest in mixed reality games. 25 participants were split into groups of five and were handed the cards with instructions describing the different stages. For a total of three hours participants then used the cards over the first day of the game jam to create a game idea that they wanted to implement the following day. As a first test for <i>Theme Cards</i> we had created five cards with short phrases or single words on them: <i>Down Under, Heaven and Hell, (Re)Distribution and Theft, GameCity, and Gamergate</i> . Data collected: notes, photos, videos, interviews.
Study 2.2	In this study one of the researchers worked together with a team of four professionals: one developer of location-based applications and three members from a cultural center. The study was embedded into a bigger hackathon-like event where members of the cultural center wanted to develop a prototype for a mixed reality game to accompany a photography festival they were organizing. We used the cards on the first day in all stages over the course of 3 hours. Data collected: notes, photos, questionnaires.
Study 2.3	In the last study we performed a short 45-minute session with three members of a nationwide charity interested in enticing the public to drive less often and instead use public transport, bicycles or just walk. An artist with expertise in creating location-based experiences completed the group. Together the participants went through the idea generation phase where we used <i>Dixit</i> cards as <i>Theme Cards</i> . Data collected: notes, photos, audio, interview.

Table 4: Overview of studies conducted during iteration 2.

Study 2.1 – Academics, Professionals, Artists

We used this study to compare the different variants for the idea generation stage with each other. In addition to this we also introduced a first version of *Theme Cards*. In general participants were not overly positive about the specific *Theme Cards* we had created, but they did seem to influence their ideation session nonetheless: “*The Theme Cards were kind of... I don't think the theme cards really helped us think of the game at all. But when we looked back we caught some theme, with the Heaven and Hell and Down Under. But that was just coincidence, I think.*” Another participant had a similar opinion: “*The themes were ok. Not particularly the kind of themes I would have chosen but they were good starting*

points for discussion, which is what I think the purpose is.” However, another participant underlines the importance of having these cards in the first place: *“I think the topics are essential for making a game jam, or making a game ideation event, because **without the topic people would find it very difficult to come up with a game idea**, so in my opinion the card set should include a number of 30 or 40 topics plus the possibility of course for the participants to create their own topics. But I would include topics into the card set.”*

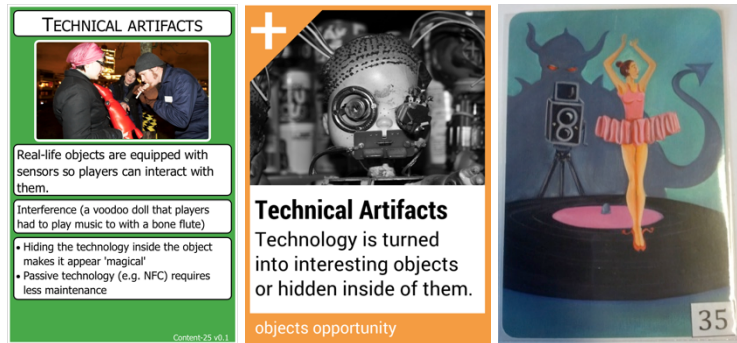


Figure 2: Opportunity Cards from iteration 1 and 2 (left, middle); Dixit card (right).



Figure 3: Inspiration for *Restickulous* (top left); poster from study 2.1 (top right); finished game from study 2.2 (bottom left); game idea from study 2.3 (bottom right)

Concerning the two variants for idea generation we received seemingly mixed feedback. One group clearly preferred variant 1. Their argument was similar to what we observed during the previous iterations: *“Somebody played SOCIAL CONTRACT, and somebody else said ‘Oh, I think USER-CREATED CONTENT really fits nicely to that’.”* Another group

member made a similar remark: “*You could really sculpt out a **strong connection** between the cards that **instantly seemed to make sense.**” When asked what they perceive as the difference between the two methods one of them described the perceived easiness when being able to select cards: “*I feel if we can play any card we like **it's much easier** because I can decide what we are going to build.*” Another participant put an emphasis on the agency that comes with a choice of cards: “*I think it probably works better when you've got the degree of choice because you can sort of **guide it in a direction you want.**” The same participant then however makes an important observation that highlights the advantage of the other variant: “*But when it's just the cards down there it could turn out really brilliantly because **the cards could design something for you, or give you the seeds for something really cool.**” Whereas variant 1 provides the participants with more agency and makes it easier for them, variant 2 forces them to be creative with potentially more interesting and unique outcomes.***

The latter is nicely illustrated by another group that designed the game *Restickulous* where you have to sneak a cardboard cut-out of the Eiffel Tower attached to a long stick into selfies that other people take. Here the participants attribute the design to the randomly drawn cards (compare Figure 3): “*That game is **exactly the three cards that we got.**” Another participant agrees: “*We made those exact three cards into a game. **We didn't deviate** I guess is the thing.*” The previous participant explains it further: “*So it was literally **us thinking about those three things, and we thought it'd be funny and that's where that came from.** [...] **We would have never come up with that otherwise.**”**

In regards to the idea development stage, a participant from another group recalls the difficulties the group had forming a coherent idea because group members kept adding *Opportunity Cards*: “*At this moment we would have needed the negative cards. **To eliminate things and to ask ourselves, what are we doing?** That's why the Question Cards were good that then said: ‘What is the core mechanic?’ etc.”*

The *Restickulous* group also described their experiences with the *Question Cards* when working on another game: “*We got in a deadlock really. We couldn't figure out how to make it a game. And we were using those to try and help. **It helped us work through the things.**” Another participant explained how the *Question Cards* stimulated the discussion while perhaps not being directly helpful in solving their deadlock: “*I think we got to the point where we thought the car game was not working, so we pulled them out. **But I don't know that they necessarily led to any changes.** [...] **But it's hard to say that's not useful in itself, because you sort of do that and you go 'hey, that didn't work', and the conversation flows on.**” The same participant however then elaborates: “*My overall feeling is the cards kind of worked. [...] **The cards stopped us from going to broad and being just crazy, and helped us narrow our focus quickly.** [...] **Having some structure that pulls you back was really useful.**”***

Study 2.2 – Content Experts, App Developer

Based on the experiences from study 2.1 we tried a different solution for *Theme Cards*: During the idea generation stage we added *VNA* cards for additional inspiration and alternatively *Dixit* cards. Feedback from the participants indicated a clear preference for *Dixit*: “*I thought the VNA cards were clever, but I didn't find them that useful. I found the Dixit cards incredible useful, because **they got my creative juices flowing and made me open up** a little bit and settle into the ideas. When people were talking there wasn't a lot of focus on the VNA.” It is fair to acknowledge at this point that the *VNA* cards are not really designed as supporting cards. The *Dixit* cards however provide a rich source for additional*

inspiration due to them being extremely detailed and surreal. Another participant put it this way: *“I think as inspiration points, **specifics don't work as well** as vague, kind of, you know, just think about the universe, sort of things. [...] It also allowed us to be unrestricted in our ideas and the Dixit card allowed us to **think outside of the box**, especially in relation to theme and its effect on the mechanics.”*

When asked about the idea development stage one participant describes the difference between the cards: *“When we first started out it felt like we had a **very sprawling idea**, kind of, and **lots of conversations about the specifics** of what these things might involve. Then later on it became a **much broader conversation** about like ‘this could be a problem for that, that, but overall it's not gonna be an issue’. You know I think we had much less specific conversations doing the questions and the negatives than we did with the positives.”* The participant illustrated his argument with an example: *“Which I think is good because **the positives are inspiring ideas**, they are things like you said, that we didn't really think about before. You know, like coming up with the TELEPHONY thing. Literally seeing the word TELEPHONY and thinking how would that relate to this project, immediately made me think of the voice mail thing. **And that's not an idea I had previously and I wouldn't have arrived at it without having an inspiration card.**”* The Opportunity Cards worked as a trigger for inspiration whereas Questions and Challenges grounded the idea and allowed it to become more concrete. Figure 3 shows how they documented their final game design idea.

Study 2.3 – Charity Members, Artist

For the final study with iteration 2 of the cards we wanted to take another look at the idea generation stage. This time we recruited three participants that normally do not engage in creative processes and let them work together with a more experienced artist. Not surprisingly the task seemed rather difficult for them, especially as we exclusively used variant 2: *“But frankly I found the whole thing really hard. Simply because **I don't think like that**. I'm not at all... It made me realize how ingrained I am in my thinking. You know. **It was quite difficult to think differently.**”* The artist however noticed how their different perspective on things actually helped in the exercise: *“I was able to copy to some extent what I already had in my head. Whereas I was amazed about the things that the three of you were coming up with. Which seemed **much more original than the reference points** I had in my head quite a lot of the time.”* One of the temptations when creating a game from four random cards is to just disregard one of them if it proved to difficult to include it in the idea. The participants were sometimes tempted to do this as well, but the artist stated why this might not be a good idea: *“Rather than saying: ‘Here's three that fit and this one that doesn't’ actually the creative bit is **making the one that doesn't fit, fit** with the three that do. **And that's where the hard work comes in** generally. Otherwise there's the danger that what the game becomes is just making connections between three of the four. And jettison the missing one. And that becomes the task then. Whereas actually the task should be to allow yourself to say anything. **To force you almost to say something different.**”* Instead of discarding a difficult card, the group policed themselves as mentioned by one of the other participants: *“I must admit, I found myself then in another role where I felt that the card with the stairs was gonna be discarded. **I was kind of quite keen to make sure that they didn't.**”* The artist agrees that this was the right move: *“And that worked actually for the stairs one, didn't it?”*

The three charity members also reflected on the interplay between the Dixit card and the Opportunity Cards (compare Figure 3):

P1: “I liked the fact that the three coloured cards with the words on **them set some rules around the game**. And then the picture card is revealed and then **kind of takes it off**.”

P2: “It’s like **a wild card** isn’t it.”

P3: “So you read the words on the cards, for me I think the picture card adds some images, some imagery, that then **takes the idea off in a way that couldn’t be achieved** if you just had three of the coloured cards and no strange picture card.”

DESIGN LESSONS FOR IDEATION CARDS

Ideation cards have been used in a diverse range of design processes. Due to their physical nature they are easily accessible and enable groups of people to collaborate in a playful and engaging manner. Ideation cards also encapsulate design knowledge in easily digestible sizes. These are characteristics that make them a potentially powerful tool for collaborative design of MRGs in multidisciplinary teams. Over the course of six studies we observed how participants created several ideas for mixed reality games (some of which were also implemented in prototype form). A small sample of these ideas can be seen in Table 5. We will now take a look at some of the important elements that constitute the *Mixed Reality Game Cards*. These can serve as design lessons for future ideation cards and sessions.

Study 1.1	Players have to find NFC tags hidden at exhibits in a local museum as fast as possible while holding their mobile phone as steady as possible. If it shakes too much, they need to go back to the starting position.
Study 1.2	Players control a virtual tribe. The game world is overlaid onto the real world and players need to provide their tribe with food etc. that they for example gather by visiting lakes.
Study 1.3	Actors are dressed up as literary characters and send players on a scavenger hunt through the city.
Study 2.1	The players take on the role of a dog that has recently escaped from a research facility and is now extremely susceptible to wireless signals. Players have to avoid Bluetooth, Wi-Fi, and mobile connectivity and make it to freedom without getting sick from radiation (see Figure 3).
Study 2.2	Players are detectives and need to visit locations of a photography festival where they have to solve clues in order to gradually unlock a greater mystery (see Figure 3).
Study 2.3	Visitors of a music festival need to use a bicycle home trainer to generate enough energy to keep the festival going (see Figure 3).

Table 5: Sample game ideas conceived as part of the different studies.

Opportunities, Questions Challenges

A defining element of our ideation cards is the fact that they are designed to help both in idea generation as well as idea development. We have achieved this by devising three types of cards: *Opportunity Cards* can be used to construct a game and define its features. *Question* and *Challenge Cards* on the other hand are used to make designers reflect on the current state of their design and shape the idea into a more concrete form. *Opportunity Cards* resemble ideation cards like *VNA* or *PLEX*. They talk about *specifics* and provide the building blocks for *inspiring ideas*. *Question* and *Challenge Cards* represent the other type of ideation cards exemplified by *The Deck of Lenses* and *Exertion Cards*. They make sure to take a potentially *sprawling idea* and create a *broader conversation* about it. They help to *eliminate things* and let designers ask themselves ‘*what are we doing?*’ They help to *narrow down* an idea and *keep the conversation flowing*.

The combination and function of these cards is reminiscent of the *Six Hat* method for brainstorming (De Bono 1999). Each metaphorical hat stands for a different type of input into the brainstorming sessions as summarized in Table 6. We can argue that *Opportunity Cards* correspond with the *Green Hat* whereas *Challenge Cards* take on the role of the *Black Hat*. *Question Cards* are most similar to the *White Hat* but not limited to the facts from before the idea was generated. Instead they let participants find the boundaries established by the idea itself. *Red* and *Yellow Hats* have no direct counterpart, but could be added as soft phases throughout the session. A *Blue Hat* moderator would however be very valuable. For inexperienced groups it is for example not easy to know when to transition

from using the *Opportunity Cards* to the next type of card. Timing is very important in this regard – otherwise designers might be tempted to keep extending and diluting an idea by adding more and more *Opportunity Cards*.

Hat	Function	Description
Blue	Moderating	Keeping the session on track and makes sure everyone follows the guidelines.
Green	Creativity	Proposing new ideas, exploring alternatives, and expressing new concepts.
Yellow	Positivity	Stating just the positive elements of the current idea(s).
White	Facts	Describing the known elements and conditions the idea has to work in/with.
Black	Negativity	Pointing out flaws and weaknesses of the current idea(s).
Red	Emotions	Voicing one’s feelings about the current idea(s) without having to justify it.

Table 6: De Bono’s Six Hat method for brainstorming.

Limited choice vs. random draw

For the idea generation stage we propose two different methods that resemble *PLEX Brainstorming* and *PLEX Scenario*. Variant 1 allows designers to choose a card to play from their (limited) hand whereas variant 2 has them randomly reveal the cards. Participants felt more comfortable with variant 1 and perceived it as being *much easier*. This variant provides them with agency by letting them decide which card to play. It allows them *guide the game idea in the direction they want*. Designers might however be drawn to cards that *fit nicely* to each other and *instantly make sense*. With the much more random second variant they cannot control as much whether such a *strong connection* can be made. From a positive perspective however the *cards could design something for you*. They can be *seeds for a unique idea* that designers might otherwise never have come up with. This method is also *much harder*. It is more difficult to shape an idea out of a completely random combination, to *make something that does not fit, fit*. This variant requires more self-control from the designers. It would be easy to just discard a card that seems impossible to combine with the rest, but *that’s where the hard work comes in*. It is even more required to say something different, to *think differently*.

Overall we recommend that inexperienced designers or designers unaccustomed with the design space of mixed reality games should start with the easier variant 1. This allows them to get a general understanding of the cards and can serve as a warm-up period. If there is a concrete goal for a game, this approach can also be better suited as it allows some steering of an idea. For creating ideas that are potentially more surprising and creative the second variant seems to be more suited. With some discipline and a reasonable time limit, designers can rapidly go through several combinations of cards and see if one of the many ideas might be worthwhile taking further.

Theme Cards

Like our *Mixed Reality Game Cards* many ideation cards feature images as part of their design. They are often added to better convey the concept of the card but also to serve an additional source of inspiration. Our approach goes a step further and adds additional *Theme Cards* to the mix that only serve this one purpose. Theme Cards are a *good starting point for discussions* and they arguably make it easier to come up with a game idea in the first place. We have found that *Dixit* cards work well for this purpose. They are overly rich in detail and thus offer several potential hooks of which to build an idea off. Good *Theme Cards* can *get the creative juices flowing* and enable *outside the box thinking*. In order to work as inspiration points they need to be *vague* and as *specifics do not work as well*. *Dixit* cards achieve this by being extremely surreal.

This is in line with findings from a comparison of *Dixit* and *PLEX* cards as a source of inspiration for designers (Kwiatkowska et al. 2014). The authors report on the suitability of *Dixit* cards for such a task: “*They allowed for free interpretation making it easier for designers to find the entry points on the given card and work further with them.*” Whereas *Opportunity Cards* set the rules around the game, *Dixit* cards play the role of *wild cards* that *make the idea take off* in often unique and unexpected ways. Without them, participants of our studies would often keep an idea at an abstract level – the addition of *Dixit* cards proved to be a great success and infused initial ideas with rich themes.

CONCLUSIONS

In this paper we have presented our *Mixed Reality Game Cards* – physical playing cards that can be used in playful ideation sessions to generate and evolve mixed reality game ideas. We combined different approaches employed by other ideation cards and created *Opportunity*, *Question* and *Challenge Cards* that support the design process in the idea generation as well as in the idea development stage. For idea generation the *Opportunity Cards* are used in conjunction with inspiring *Theme Cards* to rapidly generate several game ideas. As part of this stage we explored two variants that result in varying levels of difficulty and potential for creativity. During idea development stage all cards work together to shape the game into a more concrete form thanks to thought-provoking *Question* and *Challenge Cards*. The takeaways from our studies are not only applicable to this specific deck of ideation cards and mixed reality game design, but potentially also for other genres like board or video games, or specific subgenres (e.g. first person shooters, racing games).

ACKNOWLEDGEMENTS

The work presented in this paper was partially funded by EPSRC grant EP/I011587/1.

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