Designing with Cards

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Abstract In this chapter, we focus on design techniques that employ a particular form of design materials, namely design cards. Design cards can support different phases of a design process, from initial ideation through ongoing concept development towards evaluation of design concepts. We present three different techniques, namely PLEX Cards, Inspiration Card Workshops and the Video Card Game, and how they are used. Once we have illustrated the three techniques, we discuss general characteristics of design cards that make them great tools in collaborative design (i.e., tangible idea containers, triggers of combinatorial creativity, and collaboration enablers).

Introduction

In this chapter, we focus on design techniques that employ a particular form of design materials, namely design cards. Such techniques are good at bringing multiple participants together in making sense of observations and creating new exciting ideas.

Design cards are a low-tech, tangible, and approachable way to introduce information and sources of inspiration as part of the design process, and they have characteristics that set them apart from other media. Cards are instantly recognizable to most participants, meaning that they can serve as shared objects between diverse groups of participants. The tangible and manifest nature of design cards furthermore enable them to function as props that encourage and support design moves in a manner visible to all participants, and they are open to ongoing reconfiguration and manipulation in a very straightforward manner. Design cards can support different phases of a design process, from initial ideation through ongoing concept development towards evaluation of design concepts. Cards can

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be used with different sets of rules, depending on the design situation. Wölfel and Merritt (2013) provide a brief overview of design card sets by highlighting their key characteristics and differences. We will show three different techniques, namely *PLEX Cards*, *Inspiration Card Workshops* and the *Video Card Game*. Once we have illustrated the three techniques we will discuss more generally why such cards work.

Three Design Card Types

PLEX Cards

Playfulness is a state of mind whereby people approach everyday activities with a frivolous, purposeless and frisky attitude. Playfulness can be designed into (interactive) products and services to elicit more meaningful user experiences (Lucero et al. 2014). The Playful Experiences (PLEX) Cards (Lucero and Arrasvuori 2010, 2013) (Fig. 1) assist designers and other stakeholders in thinking about playfulness when designing and evaluating interactive products or services.

A deck of PLEX Cards consists of 22 cards, each describing a different playful experience framework category (Fig. 2). The top half of each card depicts different human emotions in an abstract way, with pictures of faces in black and white to help those using the cards focus on the emotion. The bottom half shows concrete examples from everyday life, with color pictures of hands suggesting possible interactions. The 22 cards cover different aspects of playfulness along *positive-negative*, *individual-social*, and *momentary-long term* dimensions (Lucero et al. 2014). Designers, researchers, practitioners and students alike have successfully used the PLEX Cards in their projects.

Fig. 1 A PLEX Cards Workshop

Fig. 2 Three (out of 22) PLEX Cards covering negative (i.e., Cruelty), individual (i.e., Discovery), and social (i.e., Eroticism) aspects of playfulness

Printing the Cards

Three main activities must be performed before using the PLEX Cards. The first one in order of importance is to clearly identify a design problem. The more specific the problem description and context of use are, the easier it will be to use the PLEX Cards. By combining different playfulness categories, the cards are a powerful tool to help the design team diverge and explore different aspects of the design problem. However if the design problem is too open, the PLEX Cards might simply bring about more alternatives, which might generate confusion and frustration, especially for students.

The second and third activities happen online. We originally printed and freely distributed 200 decks of PLEX Cards across different universities and research institutions around the world, but we have since run out of physical card decks. Therefore, a digital version of the PLEX Cards is now available at www.funkydesignspaces.com/plex/where people can freely download a high-resolution PDF version. The cards must be printed preferably on a color laser printer and then manually cut to form a deck of 22 cards. There are also Spanish, German, French and Polish versions of the cards available for convenience.

Using the Cards

When the PLEX cards were first created, participants would typically use the cards individually, in pairs, or in small groups of three to seven people to generate ideas. The cards would be drawn from the deck randomly, discussing one category until people felt they had to clear the table and take a new card, as they could no longer

Fig. 3 The PLEX Brainstorming technique, (**a**) The first player on the right randomly picks a card from the deck (i.e., Sympathy), the seed card, which she will put face up on the table, (**b**) Players discuss an idea after they have each placed one card on top of the seed card

come up with new ideas. Two associated idea-generation techniques – namely PLEX Brainstorming and PLEX Scenario – were devised to guide and provide structure when using the PLEX Cards.

PLEX Brainstorming

The first technique is PLEX Brainstorming, which aims at rapidly generating a large amount of ideas. Participants of the idea generation session (from now on called players) are split into pairs. Each pair is handed a deck with 22 PLEX Cards. The first player randomly picks one card from the deck and places it face up on the table so that both players can see the card (Fig. 3a). This card becomes the seed card. Both players draw three extra cards from the remaining 21 PLEX Cards available in the deck. Players look at their own cards, but not at the other's. Players can now start co-constructing ideas.

The first player begins explaining the idea on basis of the seed card. The second player listens and considers the categories in their own cards. When the second player feels that they can elaborate further on the idea, they take one card from their hand, put it down on the table, and explain how it changes the initial idea. When the first player thinks they can continue with the idea based on the cards in their hand, they pick another card and place it on the table. After three cards have been dealt on the table players can freely discuss the idea (Fig. 3b). Based on the three cards available on the table, both players agree on what the idea is about and write a description of it. Once all cards have been put back in the deck and the deck has been shuffled, then the players can start a new round of idea generation. One round takes between five and ten minutes, thus three to six rounds can be completed in half an
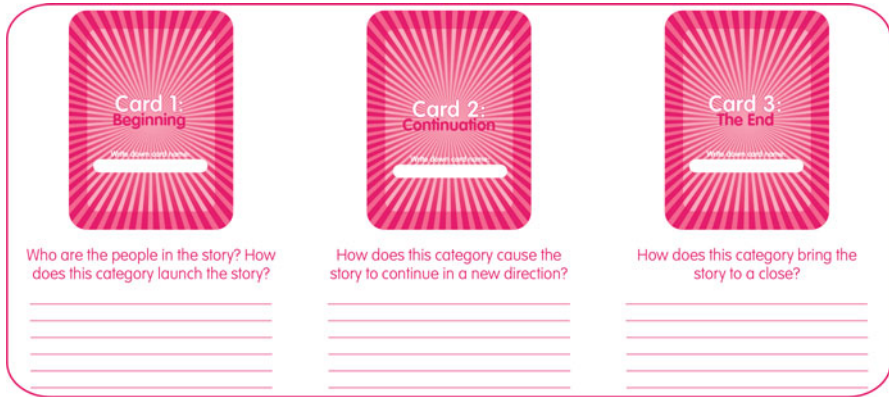
Fig. 4 The PLEX Scenario template where questions guide the scenario creation

hour. If there is an uneven total number of people, form one group of three players and allow the first player to place a fourth card on the table before discussing the idea. Having three random cards in their hands at the start of PLEX Brainstorming gives players some choice over which card they place on the table and use to extend the idea originating from the seed card.

PLEX Scenario

The second technique, PLEX Scenario, generates more complete idea descriptions in a slightly longer period of time (both compared to PLEX Brainstorming), focusing on the quality and full-roundedness of the created ideas. Similarly to PLEX Brainstorming, players are split into pairs. Each pair randomly selects three PLEX Cards from the deck of 22 cards and puts them face up on the table. Using an A3 template that can be found online (Fig. 4), players co-create a scenario using the three cards.

The scenario (or use story) is first triggered by an action related to the first card, then it is developed further by steering the story in a new direction with the second card, and it is brought to a close with the third and final card. Players are allowed to change the order in which the cards were initially drawn, until they find a combination that helps them build a scenario. The scenario is documented on the template either as text or sketched as a three-frame cartoon strip (Fig. 5a). One round of PLEX Scenario takes 10–15 min to complete, thus two or three scenarios can be created in half an hour.

In a variation of the technique, players first randomly pick seven cards and put them face up on the table (Fig. 5b). The players then create the scenario by selecting three of these available cards and place them in the order they choose. Again, you can form one group of three players with uneven numbers of people.
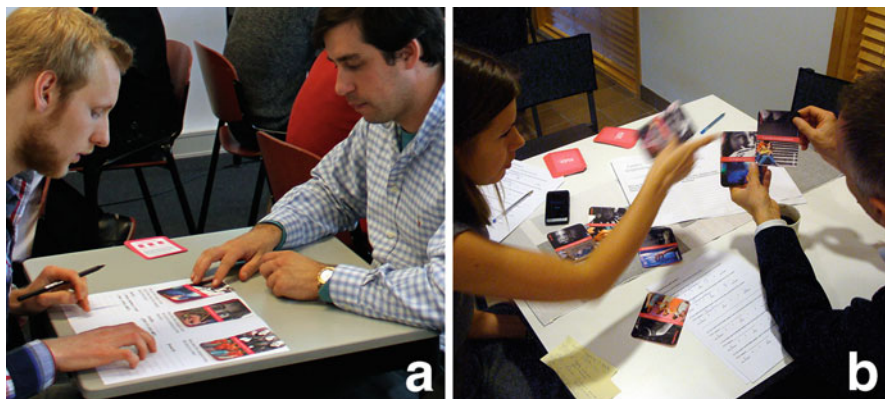
Fig. 5 The PLEX Scenario technique, (**a**) Players documenting their scenario based on three cards, (**b**) Players starting with seven random cards open on the table

After Using the Cards

One common challenge with idea generation in general is that of documentation. In the case of PLEX Brainstorming the idea can dramatically change when a new card is laid on the table. However the resulting idea is only documented when it is considered complete, i.e., after the last card has been revealed. Unless the entire session has been video recorded, interesting aspects stated in the beginning of the session may be left out of the documentation. PLEX Scenario solves this as documentation is embedded in the technique by asking players to use the A3 template to write down their ideas.

As was stated earlier, the PLEX Cards cover different aspects of playfulness, some of which one might not immediately associate with a playful state of mind. Categories that might be considered strong, controversial or difficult – such as Cruelty, Subversion, Suffering or Eroticism – can help some people think in unconventional ways, but can block others and lead them to discard some cards. When using the PLEX Cards for the first time, the facilitator should encourage people to try those potentially difficult cards as they sometimes can lead to radically new ideas.

The PLEX Cards were originally created to support people who wish to design for playfulness, and thus were meant to be used during the early stages of the design process. However, the cards have been used throughout the design process. We have seen teams keep their cards pinned to the wall as a reminder of the original idea. The cards have also operated as a checklist and a guide when evaluating the resulting product (Lucero et al. 2013).

The PLEX Cards Setup

Work space for 2–20 people:
- a laptop and projector to introduce the design problem
- enough small tables for all to fit

PLEX Brainstorming:
- a deck of PLEX cards per pair
- pens
- paper or sticky notes for documentation
- 5–10 min per round, 3–6 rounds in half an hour

PLEX Scenario:
- a deck of PLEX cards per pair
- pens
- A3 PLEX Scenario templates, 1–2 per pair
- 10–15 min per round, 2–3 rounds in half an hour

Picking which PLEX technique:
- PLEX Brainstorming better to start exploring ideas
- PLEX Scenario can then help round off ideas

Inspiration Card Workshops

An Inspiration Card Workshop (Halskov and Dalsgaard 2006, 2007) (Fig. 6) is a collaborative design event involving professional designers and participants with knowledge of the design domain in which domain and technology insight is combined to create design concepts. This method is often employed at an early stage in design projects in which designers have not yet settled on potential solutions to the design problem at hand. Alternatively, it can be employed in design projects where participants find themselves stuck or fixated on a solution they are not satisfied with and seek novel solutions.

Inspiration Card Workshops are primarily used in the early stages of a design process, during which designers and their collaborators narrow down potential future designs. The participants in an Inspiration Card Workshop are typically a combination of designers and domain experts, and the goal of the workshop is to develop design concepts from two types of inspiration cards: Technology Cards and Domain Cards. The workshop has four steps: preparation, introduction, combination and co-creation, and presentation.

Fig. 6 An Inspiration Card Workshop

Fig. 7 Inspiration Card Game cards, (**a**) Technology Card (the text translates as 'Dripping text') (**b**) Domain Card (the sign translates as 'Today's special offer')

Preparing the Cards

The main preparation activity consists of selecting and generating the two types of inspiration cards. These are index card-sized cards with a picture, a title and optionally a short text snippet.

Technology Cards, which are typically generated by the designers who participate in the event, represent technologies that may directly or indirectly be part of the design concepts. A Technology Card can represent specific technologies or interactive installations with a prominent technological component. As an example, the card in Fig. 7a, Dripping Text, is a Technology Card representing a specific application of a thermal camera tracking technology for an installation in which the silhouette of a user is tracked, allowing the user to interact with virtual text dripping down from the top of a display. To support the selection and generation

of Technology Cards, we have designed a website, www.digitalexperience.dk, where inspiring interactive systems and installations are curated. Each post on the website consists of a short presentation of an innovative technology or application, and designers can create their own Technology Cards collection for subsequent printing.

In contrast to Technology Cards, which can often be reused across projects, Domain Cards represent information about the specific domain for which novel concepts are being designed. Domain cards may pertain to situations, people, settings, or themes from the domain. Domain Cards are typically generated on the basis of studies of the domain or knowledge from domain experts. While the designers who facilitate an Inspiration Card Workshop will often produce the cards, our experience shows that it is very fruitful to involve domain experts in the generation of the cards. Figure 7b is an example of a Domain Card from a department store, and it represents a prominent sales area from the store that had been identified by domain experts as particularly important to address.

Both types of inspiration cards are developed before the main workshop event. It can take several hours to select and prepare the cards; this is highly dependent on the status of the design project. In some projects, it has already been determined that certain domain aspects or types of technologies are crucial, and the selection of cards is thus more straightforward; in other projects, these aspects have not yet been decided upon, in which case the selection and production of cards can take more time.

During the Workshop

The Introduction

The workshop itself begins with a presentation of the Technology and Domain Cards selected. Each card is presented in turn, often with the help of images or video clips, to ensure a shared understanding. In general, this takes one to three minutes per card. Designers usually present the Technology Cards, while the domain participants introduce the Domain Cards. Typically, a facilitator with experience in using the method is appointed to keep the workshop on track.

Combination and Co-creation

For the subsequent combination and co-creation step the group of participants are split into teams of 4–6 people. In this step, one or more teams of participants collaboratively combine the cards and place them on posters in order to generate and document design concepts (see Fig. 8). Based on our experience, we recommend around 10–12 domain cards and 10–12 technology cards. Too few cards can constrain and limit the creative output; too many cards can lead participants to lose the overview of the options at hand and result in much time spent searching

Fig. 8 Combination and co-creation of design concepts using Inspiration Cards

through piles of cards. We advocate for combination and co-creation taking place in groups of 4–8 participants. If more people participate, we suggest splitting into several groups after the introduction. The groups can meet to present and discuss the concepts in the final presentation step.

The combination and co-creation step is often initiated by a discussion in which the participants establish a shared understanding of the cards. There are no set rules for turn taking, and cards may be combined in the way the participants deem most productive. Participants can start by selecting themes or situations from the domain that they wish to support, or transform and then select Technology Cards as a means to this end. Alternatively, they may select intriguing technologies as their starting point, and then look for situations to which they may be applied. In addition to the two types of inspiration cards, we also suggest having blank cards that participants can fill out themselves if they want to bring a specific type of inspiration into play in the workshop.

The workshop format is intentionally very open with respect to the structure of combination, emphasizing that participants are free to pursue whichever form of amalgamation to form interesting concepts. Any number of cards may thus be mingled to create a design concept. The cards are affixed to poster-sized pieces of cardboard (Fig. 9), and participants are encouraged to write descriptions and brief scenarios on the posters in order to further sketch out and articulate the concept.

In this phase, the facilitator can play an important role if ideation does not progress as intended. The facilitator may guide the discussion and ask questions to get everyone involved, in case some participants are hesitant to engage. The facilitator may also keep an eye on the types of concepts that are being created and suggest to look in new directions if participants become fixated on a particular domain or technology card. Finally, the facilitator may help ensure that all of the concepts are adequately described. A common pitfall is to rapidly develop a concept and move on in order to keep up the pace and develop as many concepts as possible,

Fig. 9 Posters with cards combined to generate and capture a design concept

leading to concepts that can be hard to understand in the subsequent phases of a design process. Here, the facilitator can step in to prompt participants to add more content to the concept posters.

Presentation

After the combination and co-creation step, the participants take a short break to step back and reflect on the resulting design concepts. In the case of a single team of participants, each poster is discussed in plenum. In the case of several teams concurrently combining and creating posters, each group presents its design concepts. The object of this step is to ensure a common understanding of the concepts, rather than to evaluate them in terms of whether they are appropriate or realistic.

After the Workshop

The Inspiration Cards Workshop does not specify exact activities to be undertaken after the workshop. However, since the objective of the workshop is to develop design concepts, assembling a collection of concepts from the workshop typically follows it. Inspiration Card Workshops will usually result in 6–10 concepts per group involved in a one-hour combination and co-creation step, and in our experience these need to be documented and assembled so that participants can subsequently revisit and evaluate the concepts. In the projects we partake in, we assemble the concepts in catalogues that are shared among all participants. We will then meet up with the other participants at a later date to discuss the viability and potential of the concepts, normally leading to a selection of a subset of concepts.

Often, these post-workshop sessions can themselves lead to further refinement and concept development, e.g., when multiple concepts from the workshop are combined to form more refined concepts that are then brought on to the next phases of a design process, in which they may for instance be further developed through scenarios, mock-ups, prototypes, etc.

The Inspiration Card Setup

Work space for 3–15 people:
- a computer and a projector for viewing video
- one large table plus other for each team of 4–6 people
- a wall for attaching theme posters

Domain and technology cards:
- two copies of each domain and technology card per team
- blank cards for creating cards during the workshop

Other materials:
- pens, glue
- Sticky notes and A3 poster size paper

Video clips:
- one short video for each technology card

Time estimate:
- Preparing the cards: 2–6 h
- Introduction: 30 min
- Combination and Co-creation: 60–90 min
- Presentation: 20 min

Video Card Game

The Video Card Game (Fig. 10) provides a playful way for design teams to make sense of video recordings from user research. It was developed in industry to enhance collaboration between user-centered designers and engineering development teams and to encourage the development team to take ownership of user problems with their products or prototypes (Buur and Søndergaard 2000). The designers or researchers, who made the video recordings select many short clips from their material and produce a picture card to represent each clip. This allows a larger group of participants to each pick a random number of cards to study. Participants can form groups of cards on the table to suggest themes, and they can negotiate which cards belong to which theme. A Video Card Game session can typically cover 20–150 video clips with 4–16 participants and will take 3–5 h.
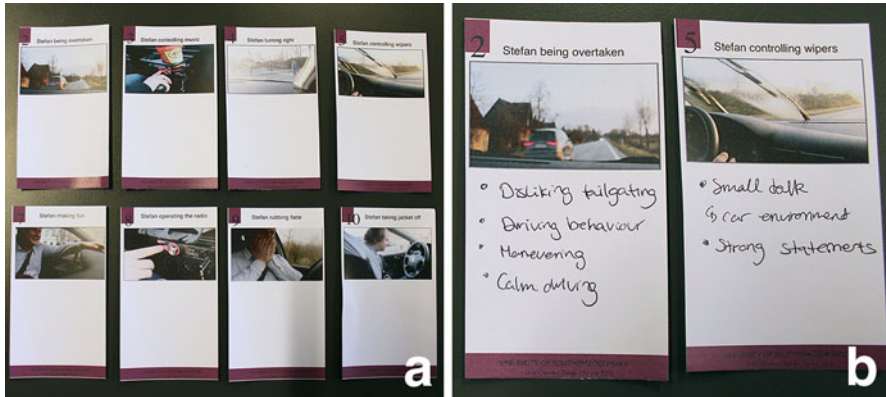
Fig. 10 A Video Card Game

In the early phases of a design project (e.g., field study and interview video), the Video Card Game helps the team make sense of recordings and form early ideas. The game typically results in often surprising perspectives on the material: the themes will describe issues worth exploring further and design opportunities that may be investigated. In later project phases, when prototypes exist (workshop and usability evaluation video), the focus will be on identifying problems, prioritizing them and finding solutions. The game encourages a focused understanding of which problems need attention.

Preparing Video Material and Cards

The Video Card Game works best with video material that contains visual activities, i.e., communicates on a non-verbal level (field observations and usability evaluation videos). Video recordings that are dominantly verbal, such as interview and discussion recordings, may better be interpreted with verbal methods, such as affinity diagramming (Lucero 2015).

In preparing the video clips and the cards (Fig. 11a) the designers or researchers who made the recordings browse their material and select clips that show the most significant actions. The clips are typically thirty seconds to two minutes long and preferably contain one closed event rather than many. There is no particular principle for selecting clips. Designers will go by their professional interests, i.e., they can pick what they find puzzling, surprising, characteristic and otherwise relevant to the project in focus. In this step they will not be expected to explain their choice of clips. The video clips will inevitably trigger observations beyond what the researchers can imagine; hence the selection of video will not steer the discussion in a very specific direction. Rather, the videos delimit the field of exploration: one cannot expect participants to talk about what they cannot see.

Fig. 11 Video Card Game, (**a**) Video cards representing 8 selected video recordings from user research, (**b**) Two video cards annotated with observations after watching each clip

The number of clips will vary depending on the material and on how many participants there are in the game. The card game usually works best with 30 to 100 sequences, and each participant can handle 10 to 20 cards in a reasonable time for making observations. The video clips should be available as separate digital files so they can be watched in an arbitrary order; any computer editing software will do. To strengthen the link between the clip and its card, they need to be named consistently.

The naming of cards and clips is significant as it influences the flow of the discussion. Using the name of the person(s) depicted encourages empathy (i.e., it makes a difference to talk about 'Lars' rather than 'this person'), and the activity description should be neutral and brief – to avoid suggesting a particular interpretation.

Numbering the clips makes it faster to refer to a particular clip in the heat of discussion. When more than one person prepares the clips and cards in parallel this means deciding on a numbering system upfront.

Setting Up the Game Table

The way the room is arranged for the video card game has an influence on the dynamics of the design discussion. We have learned that the players will not employ video during the discussion if the spatial barrier to grab the card and play it is too big, or if they have to stand up in front of the group whenever they want to make a point. The players need to be seated within easy reach of both the cards and the monitor.

In addition to organizing the space, the way participants are invited into the game as they enter the session affects how the game unfolds. It is important to establish a

playful, yet goal-oriented, atmosphere from the start. We give the researchers time to talk about the people they have met and explain how the videos were recorded. As participants only get to see snippets of the full video material, it is important to provide some broader context. This can be in the form of portrait posters (these are the people we have studied) and brief stories from the field by the researchers, who made the video recordings. Artifacts collected in the field also help establish context.

With novice participants we prefer to start with a small interaction analysis exercise with an example card to sharpen the attention on visual content, to demonstrate how different people observe differently (and that this is beneficial), and to point out the difference between observation and interpretation (which is discouraged).

Observations are things we can actually see in the video frame: they do not need inference about what people think, or about what happened before or after. For example, an observation from a video clip from a kitchen project could be, *"The woman hands the girl a plate in the kitchen."* It is something that no one can doubt when seeing it. An interpretation of the same clip could be: *"The daughter needs her mother's help in setting the table"* – but we cannot see that she will be laying the table, or that she indeed needs help. Interpretations tend to be too speculative for the sense making process and are best left to the last step of the game.

Playing the Game

The Video Card Game runs through four steps inspired by the 'Happy Families' card game for children where participants take turns to ask each other for particular cards with the aim to collect complete families of four picture cards. The game is similar to *Quartett* in Germany or *Firkort* in Denmark.

Step 1: Dealing the Cards (30 min)
The cards are dealt randomly between. A random selection helps the players focus on the contents of each individual clip.

Step 2: Reading the Cards (60 min)
The players then split up to watch the video clips from the cards that they hold (Fig. 12a). They are encouraged to watch the clips once or twice only and make quick notes that describe observations made directly on the card (Figs. 11b, 12b). By annotating each card in their own handwriting the players come to "own" the card, which is important in the later stages. If players work in pairs, each card will encourage them to formulate observations together.

Step 3: Arranging Your Hand (30 min)
When players return to the game table they are asked to group their cards openly in front of them on the table (Fig. 13a). This encourages the players to start making sense about what might be important to them in the clips. We will refer to the groups
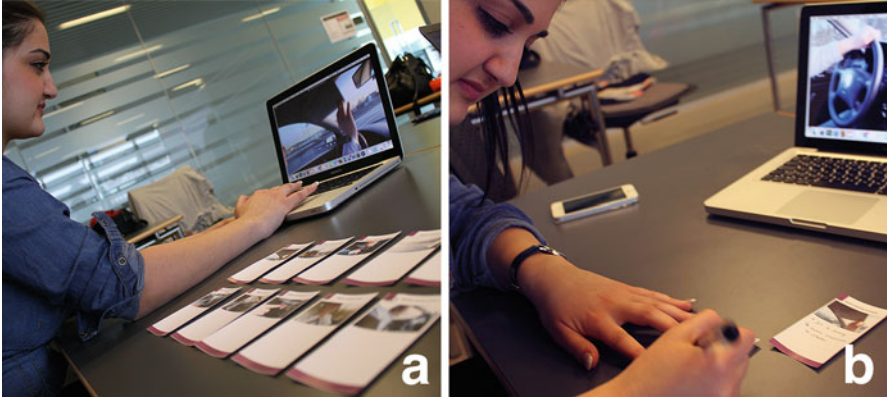
Fig. 12 Reading the Cards, (**a**) Players watching video clips in pairs from a laptop computer, (**b**) One player writes down notes with the pair's observations from that particular video clip

Fig. 13 Creating themes, (**a**) One pair arranging their hand by grouping their cards on the table, (**b**) The resulting groups of cards and their corresponding titles

as 'families.' Each player (or pair of players) around the table briefly presents their card families. There are no restrictions on how players group their cards as long as it makes sense in terms of the design activity (e.g., user activities, design problems).

Step 4: Collecting Card Families (60 min)
Each player (or pair) is then asked to choose their favorite family of cards. One after another the players describe the theme of the family they have chosen as precisely as they can. This invites the other players to contribute with cards that seem to fit into the same family. Before moving from one family to the next, the facilitator mounts the cards belonging to the family on a separate poster (Fig. 13b). If a card seems to belong in two families, the players simply make a copy. Collecting the card

families continues until all (or most) cards have found a place. The grouping of cards encourages discussion on finding the exact wording of the family heading: it needs to be precise enough to define which cards belong and which do not. By selecting their favorite family, the players also take responsibility for a theme including the labeled poster with cards.

After the Game

To gain an overview of the themes, the card family posters are pinned to a wallboard. This provides the opportunity to reflect on the immediate outcome of the game. The participants are then asked to arrange and prioritize the themes: which one do we need to discuss first? Which themes seem most important to the design project? Each 'family owner' is encouraged to lead the discussion and add notes to the poster. Since none of the players have seen all the clips, it can be advantageous to return to the video at this point. Typically each player will show and explain 'their' clips to the others, and argue how these clips are able to increase understanding about a theme.

Mock-ups, prototypes, and artifacts collected in the field have proven to be good facilitators of the discussion when they are readily available on the table to point at and think about. They help guide the discussion towards design ideas and hence help to construct a relevant focus for designing. The Video Card Game can lead beyond sense making of the material to decisions on how to move forward and what to do next. The video cards also serve as "tangible arguments" that can increase participants' confidence when they present and argue for their new ideas.

At the end of the video card game, the immediate results – the posters with video card themes and notes – are copied and circulated amongst the participants. Often this simple documentation is sufficient for participants to be able to prioritize activities and divide tasks among themselves for the next design move: who should further investigate what, or which design problems need attention.

What might go wrong? If the players choose categories of that are too general (e.g. *"Here is something about the product, and here's something about activities they do . . . "*) then the discussion will stay on a shallow level. This is an important role for the facilitator – to encourage the players to unfold their observations. Sometimes it helps to ask for a 'poetic' heading, rather than a descriptive (and boring) one!

> **The Video Card Game Setup**
>
> *Work space for 4–16 people:*
> - a screen or projector for viewing video
> - a table large enough for all to fit
> - a wall for attaching theme posters

Equipment for parallel viewing:
- computers for individual or paired viewing of video clips

Video cards:
- one card per each video clip

Video clips:
- 10–15 clips per participant
- duration of each clip 30 s– 2 min.

Examples of good combinations:
- 4 players with 10 cards each (40 video clips)
- 6 players in pairs with 20 cards each pair (60 video clips)
- 10 players in pairs with 15 cards each pair (75 video clips).

Time estimate:
- 3–5 h depending on number of participants and video cards

Why Do Design Cards Work?

We have presented three particular design cards and how they are used. But why do the *PLEX Cards, Inspiration Cards*, and *Video Cards* work? There are general characteristics with design cards that make them great tools in collaborative design (i.e., tangible idea containers, triggers of combinatorial creativity, and collaboration enablers). Once we understand these characteristics, we will also be able to develop further methods with cards.

Cards Are Tangible Idea Containers

Cards act as physical carriers of ideas. Different parts of a lengthy creative exchange between two participants can more easily be retrieved with the help of design cards who serve as physical markers around which discussions and arguments are anchored. During idea generation, the PLEX Cards have been described as useful at bookmarking thoughts and ideas (Lucero and Arrasvuori 2010). Likewise, the main feature of Inspiration Cards is exactly that they are containers of specific sources of inspiration for ideation (Biskjaer et al. 2010).

Video cards turn video clips that are otherwise intangible into objects participants can manipulate, point to, move around. One may understand the card as *design material*, i.e., something designers can use to build understanding and proposals with, rather than data to be analyzed (Ylirisku and Buur 2007). *Sense making* is just as much a negotiation of opinions in the team, as it is finding any 'right' analysis

result. Similarly, the PLEX Cards turned a complex and difficult to communicate theoretical framework into an approachable and physical material.

The process of 'reading' the video cards banks on the *ambiguous nature* of video. The world recorded on video is so complex that different people will inevitably notice different things. More eyes see more. Merging such different observations has potential in finding the new. The cards help each participant prepare before presenting to the others.

Cards Trigger Combinatorial Creativity

Design cards support what scholars of creativity refer to as *combinatorial creativity*. Researchers point out that the new combination of existing concepts is central to creativity. In 'The Act of Creation', Arthur Koestler (1964) proposed that so-called *bisociation* of matrices, in which two concepts from different domains are brought meaningfully together to form a novel concept, is central to creativity across a range of domains. Another influential creativity scholar, Margaret Boden, has pursued this line of understanding in her study of combinatorial creativity (2004). The use of design cards makes it very concrete and easy to put concepts together in a combinatorial approach.

In Inspiration Card Workshops, for instance, cards are selected exactly so that their combination can lead to novel concepts through bisociation of matrices. People often praise the PLEX Cards for their ability to produce surprising and interesting results, ideas that they normally would not come up with. The PLEX Cards have worked particularly well to solve design problems where playfulness may not be the first natural topic to consider, i.e., elderly and falls, retrieving notifications while crossing a street (Lucero and Vetek 2014). In such disparate situations, the cards work as random input that leads to bisociation of matrices.

Cards Enable Collaboration

Despite the pervasiveness of new technologies, paper remains a critical component in many collaborative work practices. Luff et al. (2004) discuss affordances of paper that seem critical to human conduct, most of which are also applicable to design cards. A card is *mobile* as it can easily be relocated and juxtaposed with other artifacts, and *micro-mobile* as it can be positioned in delicate ways to support mutual access and collaboration. It is *persistent*, retaining its form and the character of the artwork produced on its surface. Cards can furthermore be *annotated* in ad hoc ways, allowing participants to track the development of the annotations and recognize who has done what. In the Video Card Game, annotation of the cards helps transfer *ownership* of the material – even if the video was shot by someone else, we often hear the participants talk about 'my cards'. The A3 template of the

PLEX Brainstorming encourages people to make notes, write down card names, and make simple sketches as part of documenting an idea. A card also allows people to simultaneously see its contents from different angles, and it can become the focus of gestures and remarks (Luff and Heath 1998).

Cards can support and emphasize *turn taking*, as in most card games with several players. This is very prominent in Inspiration Card Workshops, in which participants will often pick up a card and present it to others, sometimes by placing it at the center of the table, as a way to emphasize the desire to add to the conversation; also, we have observed that participants in an Inspiration Card Workshop will take turns presenting a card they find particularly interesting, even if the method does not prescribe a particular order of activities. Cards support collaboration by being *shared objects for discussion* among participants. Co-creation events can be somewhat intimidating, especially to participants not accustomed to design and ideation, and a shared object can mitigate this by turning attention away from the individual participants and towards a joint marker for discussion. By lowering the participation threshold, design cards can make co-creation events more accessible to everyday people.

Conclusion

We have presented three types of design cards, namely *PLEX Cards*, *Inspiration Card Workshops* and the *Video Card Game*. We have discussed how they are used and why we believe they work in collaborative design, namely because cards act as tangible idea containers, support combinatorial creativity, and enable collaboration. The three design cards discussed in this chapter could further be combined and used in a complementary way at the start of the design process. For instance, Video Card Game cards could be prepared and be used as domain cards in the Inspiration Card Workshops. Similarly, PLEX Cards could act as domain (or experience) cards (e.g., defining a target experience without a specific context) or as technology (or emotion) cards (e.g., making people think about emotions without a specific technology in mind) in the Inspiration Card Workshops.

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