Interaction Tarot: A Card-Based Design of Knowledge Construction for Brainstorming in HCI

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Abstract
Many studies focused on how to construct a card-based inspiration tool to support designers in the early stage of their design process. However, most of these studies are very purpose-specific for informing/supporting designers with homogeneous stimuli for well-defined problems and rarely discussed the fundamental concepts underlying interaction design for comprehensive exploration in the unknown design space. To address this need, the present study proposes an approach that demonstrates how we relate archetypal images of Tarot to interaction design issues to develop an isomorphic structure, which is broad enough to cover overall interaction design notions. Based on the structure as an underlying bearer of intermediate-level knowledge, we designed an ideation tool, Interaction Tarot as design provocations not only to make academic knowledge accessible for interaction designers but also to stimulate their divergent imaginations in the ideation process where wild exploration should be embraced. Two expert reviews provided us with design considerations for its revision and indicated that Interaction Tarot could span the ideation horizons, become physical anchors to focus the idea, and open continuous possibilities to stimulate designer’s imagination.

Interaction design; Design ideation; Brainstorming; Card-based design, Creative process

There has been a growing interest in forming knowledge of interaction design for brainstorming in the early design stage (Bekker & Antle, 2011; Belman, Flanagan, & Nissenbaum, 2009; Brandt & Messeter, 2004; Deng, Antle, & Neustaedter, 2014;
Golembewski & Selby, 2010; Halskov & Dalsgård, 2006; Hornecker, 2010; IDEO Method Cards, 2002; Intùiti Creative Cards, 2011; Lucero & Arrasvuori, 2010; Mueller, Gibbs, Vetere, & Edge, 2014). While all seem to agree that card-based tools can help designers construct design knowledge and all of them are a form of construction of intermediate-level knowledge (Deng et al., 2014; Löwgren, 2013) which is used to bridge the gap between theoretical knowledge and design practice (Löwgren, 2013), with different purposes of usage of each deck reside at different contexts of use. Some scholars presented card decks as ideation tools for specific problem space. For instance, Hornecker (2010) presented a card brainstorming exercise within a tangible interaction framework for creative idea exploration in terms of a game structure. In order to design for playfulness, Lucero and Arrasvuori (2010) created PLEX cards and two idea generation techniques. Exertion Cards (Mueller et al., 2014) transformed from the abstract framework of (Mueller et al., 2011) offered designers a more efficient way to create exertion games. Other researchers, on the other hand, proposed methods for brainstorming with card decks they created in addition to designing tangible card decks for specific contexts merely. For instance, Golembewski (2010) suggested a grid-like layout would explore specific problems more effectively rather than presenting ideas one by one. Most of the above-mentioned card-based studies argued that such approach is not to offer guidance but rather to facilitate different points of view for designers to perform their creative activities within a specific context.

**Background**

Recent interaction design research has suggested that the physicality of cards may indeed encourage idea generation and facilitate broad exploration in the early design process. These specific contributions include providing a “physical anchor” to help participants have concrete design knowledge (Bekker & Antle, 2011; Deng et al., 2014; Hornecker, 2010; Lucero & Arrasvuori, 2010), increasing possibilities in early design process (Bekker & Antle, 2011; Belman et al., 2009; Brandt & Messeter, 2004; Deng et al., 2014; Golembewski & Selby, 2010; Halskov & Dalsgård, 2006; Hornecker, 2010; IDEO Method Cards, 2002; Intùiti Creative Cards, 2011; Lucero & Arrasvuori, 2010; Mueller et al., 2014), and building the common language to facilitate collaboration between stakeholders (Brandt & Messeter, 2004; Deng et al., 2014; Halskov, 2006; Lucero, 2010), as well as bridging the gap between design theory and practice (Bekker, 2011; Deng et al., 2014; Hornecker, 2010; Halskov, 2006; Lucero, 201; Mueller et al., 2014).

In this paper, we will use the term **purpose-specific** to refer to a tool that is purposely designed for well-defined problems and is powerful/quickly for concrete concept generation, such as PLEX Cards for pleasure design (Lucero & Arrasvuori, 2010) and Exertion Cards for exertion game (Mueller et al., 2014); and **general purpose** we understand as a tool that is intentionally designed with the goal of stimulating divergent imaginations for designers to do comprehensive probing, such as Intùiti Creative Cards (Intùiti Creative Cards, 2011) for opening continuous questions. As shown in the above literature review, however, most of
these card-based tools are very *purpose-specific* and the generated concepts would be homogeneous and convergent. While inspiring interaction design in a more general and open-ended way within ideation, we see a need to employ a set of cards that are general enough while grounded to the underlying structure of interaction design for comprehensive exploration in even the unknown design space and stimulating fertile imaginations.

The purpose of the research here is to explore how to design a tangible card deck with an overall structure of interaction design to enable idea generation benefited from two expert reviews and fine-tuning the deck. The specific aims in this report are (a) to propose a set of underlying structure based on Tarot (Pollack, 2002) grounded in the theoretical approach of Jung’s psychology (Semetsky, 2011) (b) to elucidate how such structure would support design researchers to construct intermediate-level knowledge of interaction design for designers through developing the card-based design, e.g., Interaction Tarot. Furthermore, the underlying structure of interaction design has not been studied yet in HCI. It is therefore the intent of the present study to explore the possible form, followed by a discourse on the symbolic meanings and *archetypal images* (Semetsky, 2011, p.12) of Tarot, intermediate-level knowledge, and card-based design.

To address the issues already mentioned and to open a new field to differ from the prior studies, this paper focuses on addressing the following research questions:

- What is the *possible form* of the fundamental structure underlying interaction design?
- How does this research make academic knowledge accessible for interaction designers in their design practice through a set of card deck, e.g., Interaction Tarot, or even make design provocations based on the *possible form*?

In this paper, we present a new tool for ideation, Interaction Tarot, as design provocation to stimulate designers’ imagination in interaction design. The next section will discuss the prior studies, and then, we will introduce the prototype of Interaction Tarot and the revisions of it through design considerations from prior studies and suggestions from pre-workshops, which gave design researchers multi-dimensional suggestions to thoroughly explore the possible problems within the practical use of it. We further conducted workshops to probe how it provided design provocations for interaction designers, inspired their creativity in the ideation process, and facilitated processes beneficial to brainstorming. Through the expert suggestions we had better understandings on the practical benefits of Interaction Tarot. Finally, we will provide a rigor discussion and conclusion section in a hope to articulate that the present research may serve as a basis for the future study in interaction design research to bridge the theoretical knowledge and design practice.
Literature review

The structure of card-based design

For recent years, researchers have worked to form various frameworks for specific situations and presented ideation tools based on purpose-specific frameworks. For instance, Bekker and Antle (2011) presented child-specific cards that can be used to make conceptual knowledge accessible to designers on facilitating developmentally situated design. Belman et al., (2009) developed a systematic approach to considering values in game design and created a curriculum for generating value conscious design with Grow-A-Game cards. Tango Cards (Deng et.al, 2014) made knowledge accessible to designers by informing the design of tangible learning games. IDEO method cards (2002) were classified as four aspects that define the types of activities and are illustrated by real-life figures of how each approach was associated to a specific project. Hornecker (2010) presented an approach to generating ideas within the structure of her tangible interaction framework, including tangible manipulation, spatial interaction, embodied facilitation, and expressive representation (Hornecker, 2006) and provided open-ended questions and provocations. Mueller et al., (2014) followed a similar approach to turning the exertion framework (Mueller et al., 2011) into Exertion Cards and tended to support the creative game design process. Lucero (Lucero & Arrasvuori, 2010) designed four versions of the PLEX Cards based on 22 categories of the playful user experience and proposed PLEX Brainstorming and PLEX Scenario as idea generating techniques.

On the other hand, some researchers developed methods of creating card decks as probing kits to expose problems within real situations. For instance, Brandt and Messeter (2004) presented four design games to improve idea generation and to span the gap between different understandings of different stakeholders in a hands-on scenario. Halskov and Dalsgård (2006) presented the Inspiration Workshop as a collaborative method to successfully frame and guide workshops through two categories of cards, Domain Cards and Technology cards. Intütüti Creative Cards (2011) composed of 78 cards with 78 evocative tales are an inspiration tool to open continuous questions instead of providing an answer to create something new.

All of these card decks were created to bear various design knowledge, and to support designers to frame the real problems or possibilities in the early stage of design. However, these studies intended to design ideation tools for specific situations, and were not conducted in general situations. We argue that these prior studies might restrict the imagination of ideation and limit the diversity of idea generation in the early design process where wild or ridiculous ideas should be embraced and encouraged. Besides, lots of card decks were designed to inform how knowledge was learned and focused on the well-known problem space in all sorts of ways, but they were seldom designed as probing tools in exploring the unknown design space. Therefore, the present study attempts to provide a set of framework which is broad enough to bear intermediate-level knowledge of interaction design and not
only makes academic knowledge accessible for interaction designers but also provides
design provocation for ideation through a physical card deck with the overall framework.

Design knowledge

Löwgren stated “The essence of research is to produce knowledge…” (Löwgren, 2013), and
argued that intermediate-level knowledge which occupies territory between the general
theory and particular artifacts represents a valuable and crucial part of design knowledge. He
briefly illustrated some examples of intermediate-level knowledge forms such as the
following: design methods, design guidelines, patterns, concepts, experiential qualities,
strong concepts, and annotated portfolios (Löwgren, 2013, pp.32-33). Besides, Stolterman
and Wiberg (2010) also stated that not all the knowledge are expressed in typical research
outcomes in the design research, they have to be designed as artifacts which become a
carrier of design knowledge, and the concept-driven approach they proposed can constitute a
foundation for future design research projects. From Pierce’s point of view (2014), the
operational design prototypes and products, conceptual and material design studies and
experiments, and design proposals are all included in design knowledge. Even the epistemic
artifacts (Hansen, 2009) could be a vital role to offer design researchers the advantage of
doing practice-based design research. In the above-mentioned prior research about design
knowledge, design researchers intended to exhibit “the collaborative knowledge production
that accommodates the nature of design practice without undue scientistic reduction”
(Löwgren, 2013, p.34).

Tarot as a design resource

Most of the previous studies on Tarot grounded in the existent framework of Jung’s
analytical psychology (e.g., Auger, 2004; Banzhaf, 2000; Pollack, 2002; Semetsky, 2011)
where the essential feature of human experience is revealed in ancient myths all over the
world, and Jung speculated the collective unconscious as the universal mind of human to live
with in the deep mind. Semetsky (2011, p.12) took the perspectives that “archetypes reside
in the dynamic field of the collective unconscious and form an unorthodox virtual foundation
upon which many individual real-life experiences lay down their own structures…the
unfoldment of archetypal dynamics in real-life individual experiences expressed by the
constellations of Tarot pictures”. Therefore, we saw the underlying structure of Tarot as a
kind of design resource and aimed to investigate the comprehensive notions in interaction
design instead of directly using the “language of initiates” in occult philosophy. As the Intúiti
Creative Cards (2011) claimed, “It has not an esoteric purpose: each card is related to a
thinking model that belongs to our culture, a powerful incentive that can put in motion
creative and inspirational processes”. Such archetypal images (Semetsky, 2011, p.12) of
Tarot provoked our design researchers and gave them rich imaginations of the real situation
in the life world. Moreover, based on Tarot, Interaction Tarot could span a large range of
interaction design space to provide broad physical anchors for supporting designers to open
continuous problems and explore new possibilities instead of informing design knowledge or well-known design problems.

**Developing Interaction Tarot**

First of all, we followed the similar approaches to the “contextual grounding” of strong concepts (Höök & Löwgren, 2012, p.23:11) which could be an instance designed “to respond to a particular existing use situation”, “to explore a possible use situation”, or “to concretize or instantiate a specific theory of human behavior”. Therefore, we abstracted some design notions from the existing design cases to form the core concepts of interaction design. We are also in line with Stolterman and Wiberg’s arguments (2010), seeing the design concepts and artifacts as carriers of knowledge where they intended to develop an approach that could deal with research practices and academic approaches. From the discourse of annotated portfolio (Gaver & Bowers, 2012), which is classified as a form of intermediate-level knowledge (Löwgren, 2013), Bower (Bower, 2012, p.76) stated the concept of annotated portfolio “as a means for capturing the family resemblances that exist in a collection of artefacts, simultaneously respecting the particularity of specific designs and engaging with broader concerns”. Therefore, we argue that design knowledge might be constituted and formed by “contextual grounding” from existing prototypes or design concepts.

**Contextual grounding**

Based on the contextual grounding, we tried to construct abstract design concepts of practical orientation in interaction design. Logistical issues prevented us from discussing all the design considerations of the constructing process. Therefore, we just take one example here to demonstrate how we construct the essential values of the design instance. As Figure 1 shows two previous projects on tangible interaction design, Twins (Chung, Chiu, & Liang, 2013) and InTouch (Liang, Chung, Kao, & Lin, 2013) as two examples, we could obtain some core intentions from Twins including body movement, openness, ambiguity, communication, embodied interaction, richness, and twins. On the other hand, we could obtain partially analogous intentions including embodied interaction, openness, ambiguity, warm-up, and care from another design case, InTouch. Through duplicated abstraction from lots of design cases, we could obtain isomorphic structure of design intention. However, it is impossible to make exhaustive inquiries to obtain a comprehensive structure of interaction design. Further, owing to the limitation of sampling cases, the abstracted notions produced by contextual grounding or annotated portfolios would be one-sidedness and subjectivity, we argue such design method is hard to completely span a broad and overall structure of interaction design.
Because we intended to build a general tool with broad aspects to bear intermediate-level knowledge of interaction design, which was not yet specifically created in HCI community, we tried to use the archetypal images of Tarot as design resources for developing an isomorphic structure. Such perspectives of ancient people who explored the association between human beings and nature inspired the present research to postulate several lived experiences we were interested between technology and the lived world. We believe that such approach with Tarot structure would highlight multi-dimensional perspectives and stimulate designers’ fertile imagination instead of informing designers only (Deng et al., 2014) or merely supporting the design flow on learning (Mueller et al., 2014).

The symbolic meaning and the astrological sign as design resource

The research team referred to the structure of the Major Arcana of Tarot, which consists of 22 symbolic meanings as design provocations to reconsider the real situation in daily life. As Banzhaf (2000, p.7) stated “a symbol doesn’t attempt to conceal anything apparent. To the contrary, it illustrates something that is greater and extends deeper than words can express or that our minds can comprehend”, the symbolism of the Major Arcana stimulated rich imaginations surrounding interaction issues that we cared about. There might be some deeper structures of human behaviors that indicated how human being live with technologies, and “these deep evolving meanings express themselves through archetypal images that act as symbolic transformers capable of making unconscious contents manifest at the level of conscious awareness” (Semetsky, 2011, p.12). As Table 1 shows (Pollack, 2002, p.231), those astrological signs of Tarot provided some semantic or pictorial messages and became a material medium to “makes the invisible visible” (Semetsky, 2011, p.21) for design researchers. Hamaker-Zondag (1997, p.178-184) presented a list of the astrological correlations with the Major Arcana cards from different aspects of 7 authors. From the viewpoint of Jungian psychology, “astrology was simply a system of archetypal images”
(Auger, 2004, p.15). Pollack also states “archetypes are found not only in mythology but in social and cultural institutions” (Pollack, 2002, p.32). As Tarot has framed life world with a set of astrological symbols and their archetypal meanings for hundreds of years and had been well used as tools for interpreting and predicting life issues, as well as reflecting and suggesting, we boldly believe that we could more comprehensively frame interaction design with such isomorphic structure in Tarot if the design space is broad and vague from the outset. Namely, if we seek to possibly include designers’ unconscious contents and imagination as creative resources, Tarot seems to provide better explorations than other purpose-specific structure. Based on the understanding of Tarot archetypes, our design researchers considered the symbolic meanings that have some relevance for the real situation and named the corresponding design meanings (design interests) that are not only from the theoretical approach of prior studies but also ideas abstracted from contextual grounding.

Table 1: The Mapping between Tarot and Design Notions: The astrological signs of Tarot inspired the design notions of interaction design issues. (Pollack, 2002, p.231)

<table>
<thead>
<tr>
<th>No.</th>
<th>Tarot</th>
<th>Astrological Sign</th>
<th>Design Notions</th>
<th>Symbolic Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>The Fool</td>
<td>Uranus</td>
<td>Material</td>
<td>Innocence</td>
</tr>
<tr>
<td>1</td>
<td>The Magician</td>
<td>Mercury</td>
<td>Communication</td>
<td>Application</td>
</tr>
<tr>
<td>2</td>
<td>The High Priestess</td>
<td>Moon</td>
<td>Emotion</td>
<td>Knowing</td>
</tr>
<tr>
<td>3</td>
<td>The Empress</td>
<td>Venus</td>
<td>Aesthetics</td>
<td>Abundance</td>
</tr>
<tr>
<td>4</td>
<td>The Emperor</td>
<td>Aries</td>
<td>Personal</td>
<td>Rulership</td>
</tr>
<tr>
<td>5</td>
<td>The Hierophant</td>
<td>Taurus</td>
<td>Resource</td>
<td>Knowledge</td>
</tr>
<tr>
<td>6</td>
<td>The Lovers</td>
<td>Gemini</td>
<td>Social</td>
<td>Union</td>
</tr>
<tr>
<td>7</td>
<td>The Chariot</td>
<td>Cancer</td>
<td>Sharing</td>
<td>Driven</td>
</tr>
<tr>
<td>8</td>
<td>Strength</td>
<td>Leo</td>
<td>Fun</td>
<td>Courage</td>
</tr>
<tr>
<td>9</td>
<td>The Hermit</td>
<td>Virgo</td>
<td>Search</td>
<td>Searching</td>
</tr>
<tr>
<td>10</td>
<td>The Wheel of Fortune</td>
<td>Jupiter</td>
<td>Random</td>
<td>Reincarnation</td>
</tr>
<tr>
<td>11</td>
<td>The Justice</td>
<td>Libra</td>
<td>Balance</td>
<td>Balance</td>
</tr>
<tr>
<td>12</td>
<td>The Hanged Man</td>
<td>Neptune</td>
<td>Metaphor</td>
<td>Sacrifice</td>
</tr>
<tr>
<td>13</td>
<td>Death</td>
<td>Scorpio</td>
<td>Ritual</td>
<td>Termination</td>
</tr>
<tr>
<td>14</td>
<td>Temperance</td>
<td>Sagittarius</td>
<td>Intercultural</td>
<td>Healing</td>
</tr>
<tr>
<td>15</td>
<td>The Devil</td>
<td>Capricorn</td>
<td>Business model</td>
<td>Curse</td>
</tr>
<tr>
<td>16</td>
<td>The Tower</td>
<td>Mars</td>
<td>Compete</td>
<td>Sudden Shift</td>
</tr>
<tr>
<td>17</td>
<td>The Star</td>
<td>Aquarius</td>
<td>Future</td>
<td>Hope</td>
</tr>
<tr>
<td>18</td>
<td>The Moon</td>
<td>Pisces</td>
<td>Care</td>
<td>Fear</td>
</tr>
<tr>
<td>19</td>
<td>The Sun</td>
<td>Sun</td>
<td>Vision</td>
<td>Life</td>
</tr>
<tr>
<td>20</td>
<td>Judgement</td>
<td>Pluto</td>
<td>Function</td>
<td>Resurrection</td>
</tr>
<tr>
<td>21</td>
<td>The World</td>
<td>Saturnian</td>
<td>Form</td>
<td>Achievement</td>
</tr>
</tbody>
</table>

Taking the first card The Fool as an example, the initiate of archetypal journey, which represents the psyche in the process of individuation and self-realization (Semetsky, 2011, p.36), is the analogy of the start of interaction design. We associate with its archetype of
Tarot, the symbolic meanings of Uranus, which “emphasizes the unexpected” (Pollack, 2002, p.32), and the first thing interaction designers need to do is to explore and “form through experiments with materials and purposeful play” (Baskinger & Gross, 2010, p.8). Maeda insightfully claimed that "...the computer less as a tool, and more as a new material" in 2005 (Maeda, 2005). On the basis of prior studies we saw the connection between the archetype of The Fool card and the design notion, Material, which “are not just a given to be selected based on designer’s calculation, but are a part of design problem” (Jung, 2011). Based on the modern hermeneutics, “polysemic”, “the sense of all meaning-bearing units is always context-dependent, situation-bound” and “the same meaning can be expressed in several ways” (Alvesson & Sköldberg, 2009, p.79), our aim here is not to provide an absolute mapping or scientific reduction between interaction design notions and Tarot archetype but present a possible approach to exampleing how we relate to them.

The pre-workshops for design concepts

We used these design notions inspired by Tarot as the main concepts of each card and we also invited the designers to create paintings according to the meanings or metaphors of each card on the front side. While the main concepts were intended to cover whole issues of interaction design, we were afraid that it might be too vague for novice to draw wild inspiration. Besides, based on the “polysemic” (Alvesson & Sköldberg, 2009, p.79) and the “indexicality” addressed by Husserl “a meaning-bearing unit may have more than one sense”, we added some related concepts and questions on the back side of Interaction Tarot to facilitate users to have more imaginations and we conducted two simple pre-workshops for extending possible related concepts. Researchers invited 11 graduate students who are familiar with interaction design from Department of Industrial and Commercial Design in National Taiwan University of Science and Technology to help us have more fertile imaginations. Each workshop lasted one hour and 11 participants were asked to list some annotations, including contextual grounding and the symbolic meanings of Tarot.

After carefully coding, sorting, synthesizing, and discussing, for each card we chose about 11 annotations which are not only highly related to the main concept but also easier to do divergent thinking as related concepts placed on the bottom of the back side of the card. Further, based on the main concept of each card, we created a design question respectively to encourage critical thinking and placed it on the top of the back side (Figure 2).
Interaction Tarot

As the Figure 3 shows, the first version of Interaction Tarot includes 22 rectangle cards with rounded corners, approximately 75 mm by 115 mm in size. Based on the card sorting (Martin & Hanington, 2012, pp. 26-27; Spencer, 2009), researchers classified the cards into 3 categories in terms of its characteristics: (1) VALUE cards with green color: Vision, Resource, Fun, Care, Personal, Future, and Emotion, (2) METHOD cards with orange color: Aesthetics, Balance, Function, Form, Material, Search, Ritual, Metaphor, and Business Model, and (3) INTERACTION cards with pink color: Random, Intercultural, Social, Sharing, Compete, and Communication. On the layout design, while the complicated information hierarchy of a card “could defeat its purpose” by repeated use (Deng et al., 2014), therefore, our visual designer struck the balance between implicitness and explicitness to decide the appropriate layout by trying all possibilities in font size and colour coding carefully according to the importance of each part. We aimed to provide optional categories and related concepts for the participants if necessary rather than persuade them into framing ideas with selective information. The copy of Interaction Tarot can be downloaded from http://interactiontarot.wordpress.com.
Expert review

Since Interaction Tarot are designed as general purpose, we conducted 2 workshops with different interaction design issues to understand if the card contents were appropriate and what limitation of the cards might occur for designers in the early stage of the design activity.

Procedure and tasks

We invited 7 graduate students who are also familiar with interaction design and came from different disciplines to participate the workshops (some of them participated one workshop only), approximately 2 hours in total.

Since the exploration and convergence are two trustworthy ways of idea productions for ideation (Guilford, 1967), we conducted the brainstorming meeting with two sessions which are used to reflect the different bridging dimensions on divergent and convergent respectively, with different issues in each workshop (Table 2). Each workshop was followed by semi-structured interview.

In Divergent Session, each participant was asked to choose one card that is regarded as most relevant or useful to the issue, and then, one was asked to write down or sketch out any related ideas around the issue, the chosen card and the sharing from other participants. In this
session, the facilitator encouraged “wild ideas”, “go for quantity”, and to build on the ideas of others (Kelley & Littman, 2001, pp.57-58).

Table 2: The real cases of interaction design for brainstorming: Skube (2012) and Good Night Lamp (2015) as stimuli

<table>
<thead>
<tr>
<th>Workshop</th>
<th>Participants (#)</th>
<th>Issues (stimuli)</th>
<th>Sessions</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>workshop #1</td>
<td>5</td>
<td>Skube</td>
<td>Divergent</td>
<td>50 min</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Convergent</td>
<td>50 min</td>
</tr>
<tr>
<td>workshop #2</td>
<td>6</td>
<td>The Good Night Lamp</td>
<td>Divergent</td>
<td>50 min</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Convergent</td>
<td>50 min</td>
</tr>
</tbody>
</table>

After the Divergent Session, a 5-minutes-break was given, and then, each participant was asked to randomly draw one card from the remaining cards in Convergent Session. Participants were asked to synthesize one or more annotations produced in Divergent Session, the issue, and the new cards they drew into a brilliant conceptual interaction design by reconstruction and visualizing scenario. All of the facilitator had to do was to encourage the unique idea of their own and avoided the evaluation apprehension and production blocking when they presented their ideas in turn (Figure 4).

Figure 4: Two brainstorming sessions are designed for divergent and convergent of idea productions.

Data collection & analysis

After 2 workshops, we randomly selected and interviewed four participants to obtain retrospective data on the brainstorming meeting. Interviews were about 30 minutes and all responses were kept as voice record for analysis. The interview data were grouped into some headings and coded. During coding, the data were revised and refined to more phenomenologically reflect the data, and these categories reflected the real situation of card uses more precisely. Further, in an attempt to analyze the effectiveness of each card, we
conducted the observations, collected accounts, and performed stimulus recall with respect to two sessions.

**Research result and findings**

**Card uses in workshop #1 & #2**

From the experts’ opinions, four research findings of real situation emerged as follows.

*Information Hierarchy:*

Most participants agreed that the information hierarchy of Interaction Tarot gave them wild imaginations. However, the colour cover in the front side is harder to offer imaginations than others in the back side:

“...the information in the card is enough, but I seldom use the ‘Question’ part of it. Mostly, I use the ‘Related Concept’ part...” [P5]

“...the information is just right... I seldom use the colour cover..., but the images can support me on form exploration and manifestation...” [P7]

“...sometimes, the colour images are able to touch me... part of them are too specific to indicate objects or artifacts, that will let me to focus on the main theme... a series of images to express the meanings is better, I suggest...” [P2]

Experts’ opinions gave us some suggestions for revising it in the revision.

*Usefulness:*

Participants stated that most cards are useful for idea generation and strengthen their ideas of divergent thinking:

“... ‘Social’, ‘Care’, ‘Emotion’, ‘Communication’, and ‘Random’ are useful for me...” [P5]

“... ‘Random’, ‘Social’, ‘Communication’, and ‘Compete’ are my first priority to think about the interaction design...” [P1]

“...All cards are useful, for me...” [P7]

“...I am extremely sensitive to ‘Metaphor’, ‘Communication’, ‘Emotion’, and ‘Ritual’... something beyond the artifact is more attractive my attentions...” [P7]

P1, P2, and P7 also responded with negative feedback on the card, Business Model, for example:

“...for me, it is very hard to have imagination when I used ‘Business Model’, because the main idea of it relates to a final product but prototype...” [P1]

Although most participants agreed that Business Model is hard for ideation, P5 had the different opinions, in his own words:
“...Although everyone indicates that ‘Business Model’ is hard to use, but I don’t agree...I think, it forced me to think more about the reality at the reflective level, but not at the problem solving level...” [P5]

After we gave some interpretation of Business Model to participants, such as the communication between stakeholders and team members:

“...if so, there was a past example about that...there was a workshop with an issue about how different background designers lived together in the apartment...” [P2]

After the discussion with design researchers, we adjust the Business Model to Responsibility and change the category from METHOD to VALUE to easily remind designers the relevance to stakeholders and social responsibility.

Span the ideation horizons and focus the idea:

The researchers observed that Interaction Tarot helps participants span their horizons in addressing divergent problems:

“...Cards pushed me to think about some existing artifacts...I think physical cards could be guidance for concept rearrangement...” [P2]

These observations are in line with the prior studies (Bekker & Antle, 2011; Deng et al., 2014; Golembewski & Selby, 2010; Halskov & Dalsgård, 2006; Hornecker, 2010; Lucero & Arrasvuori, 2010; Mueller et al., 2014) that indicate cards enable designers to “formatively evaluate their ideas” and “guide them in developing and fleshing out ideas” (Deng et al., 2014). In addition, the participants also commented how Interaction Tarot facilitates the ideas and focuses on specific concepts in convergent session:

“...the related concepts of ‘Material, such as sounds, light, smell, and temperature, help me have more imagination, besides, the card (‘Business Model’)...further keeps my focus on the sounds and temperature issue. From these ideas, I have brilliant ideas about an adaptive musical environment...” [P5]

“...the imagery elicited by the ‘Emotion’ card became a warm, adorable, and downy Chihuahua on my leg and the imagery facilitated from the related concepts of ‘Material’ card, sounds, light, smell, and temperature, let me to relate the towel, soft material, leather product and weave. Suddenly, I had a compound idea on drawing my sketch and proposed a breathing lamp which can be lightly stroked in my hand.” [P2] (Figure 5)
Cards as anchors:

A Card does not restrict the thinking but does provide an anchor for designers to find out problems, even an issue they had never thought about before:

“...my thought habits were getting out of control easily...those cards provided me with any other clues about interaction design...” [P7]

This observation was similar to the prior study: a card-based tool becomes physical anchors, and makes ideas tangible (Bekker & Antle, 2011; Deng, et al., 2014; Hornecker, 2010; Lucero & Arrasvuori, 2010). Furthermore, Interaction Tarot does not only provide physical anchors for design ideation, but also leave spaces for inspiration (e.g., Intùiti Creative Cards, 2011) and do inspire the unknown aspects for participants to probe the under-constrained problem rather than providing examples to serve as stimuli for learning (e.g., Deng et al. 2014).

“...in contrast to the portfolios which I often used as ideation stimuli for product design, Interaction Tarot gave me some vehicles to imagine... some cards remind me to think what I didn’t concern before, for instance, ‘Business Model’...” [P2]

P2's opinion could confirm previous arguments that Tarot indeed provides better explorations to probe the unknown design space than purpose-specific structure. Besides, P2 gave us richer understandings of Interaction Tarot:

“...for me, the related concepts are the same as the main concept, all of those give me more imaginations... therefore, there are at least 12 concepts for ideation of each card.” [P2]

This insight indicates that Interaction Tarot is not only designed as 22 physical anchors but also 22 sets of associative meanings. This observation is in line with the claims, “the same meaning can be expressed in several ways” (Alvesson & Sköldberg, 2009, p.79), and those
design notions we proposed here seem to “allow family resemblances to be reasoned about, rather than deductions made” (Bower, 2012, p.76).

Discussion

In this paper, we aim at providing comprehensive physical anchors, attempting to cover overall aspects of interaction design that “make the invisible visible” (Semetsky, 2011, p.21). Since our intention here is to construct a tool with a general/open-ended purpose for designers to explore the unknown design space, the present study doesn’t provide a purpose-specific framework to support learning or inform design knowledge but proposes a similar approach that advocates “the relation between sign and expression is thus many-to-many rather than one-to-one” (Alvesson & Sköldberg, 2009, p.79), to elicit participants’ personal understandings from different disciplines or tacit knowledge of interaction design for design ideation with various interaction design topics through constructing interaction design notions inspired by Tarot. The findings also indicate that those associative meanings could be captured by a main concept and its related concepts, which offered a common language (Brandt & Messeter, 2004; Deng, Antle, & Neustaedter, 2014; Halskov & Dalsgård, 2006; Hornecker, 2010) and inspiration basis for ideation, discussion, and coordination in the cross discipline situation.

Through two expert reviews, we adjusted the information hierarchy, which consists of diverse design notions inspired by Tarot to re-construct a form of intermediate-level knowledge of interaction design for ideation. The result indicated that Interaction Tarot can help designers be able to span the horizons on different perspectives and encourage wide and brilliant divergent thinking. In the hands-on practice, Interaction Tarot supported designers to have new visions and observe fruitful concepts they had never concerned before. The observations also showed that Interaction Tarot not only makes design knowledge accessible for designers but also opens continuous questions and provides possible design opportunities for them to explore the unknown design space.

Although the related concept part is designed for broadening the perspective range of individual card to bridge different pre-understandings of novice participants, the 22 sets of associative meanings still span different scales of design space for designers. Another problem is compounded by the openness of information hierarchy. Although the complicated information hierarchy of a card (e.g., related concepts, design questions, and categories) could effectively make explicit knowledge for convergent thinking, however, too specific annotations would restrict the flexibility of ideas or reduce the creativity of divergent thinking. Because we aimed at providing an inspiration tool that is broad enough to bear a form of intermediate-level knowledge of interaction design, we struck the balance between implicitness and explicitness to prevent restricting ridiculous ideas, encouraged rich imagination through presenting the possible framework of interaction design, and tried all possibilities in layout design carefully.
Conclusion

The present study proposes an approach that illustrates how we relate the archetypes of Tarot to interaction design issues to develop an isomorphic structure, which is broad enough to cover overall interaction design notions to provide better explorations on probing the unknown design space in the early design process, rather than providing homogeneous /convergent card sets for purpose-specific design. Seeing the structure as an underlying bearer of intermediate-level knowledge in interaction design, we propose an ideation tool, Interaction Tarot to bring out designers’ personal understandings from different disciplines or tacit knowledge of interaction design for design ideation. The expert reviews showed that our design could open the continuous possibilities, stimulate designer’s imagination, and even make design provocations for designers. To conclude, we reiterate our intention with a quote from Albert Einstein:

“Imagination is more important than knowledge. For knowledge is limited to all we now know and understand, while imagination embraces the entire world, and all there ever will be to know and understand.” - Albert Einstein (1929)

Interaction Tarot is still in the experimental stage and much more has yet to be done. However, this research provides a descriptive basis for additional research and we hope this study will encourage further investigating on how to construct an inspiration tool as design provocation to stimulate designers’ imagination instead of providing a tool with fixed framework for informing/supporting designers on specific design space.

References


**Author Biographies**

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David W. Chung is a Ph.D. candidate at the dept. of Industrial and Commercial Design in National Taiwan University of Science and Technology. He received his MEng in Information System and Applications from National Tsing Hua University, specializing in image processing and had worked for years in UserJoy Technology Co. Ltd., where experiencing game design to develop engagement strategy from the long-term investigation of the user behaviors. Now, he is a member of Spatial Media Research Group cooperating with Prof. Rung-Huei Liang in NTUST. His research focuses on tangible embodied interaction, card-based design, and intermediate-level knowledge. Through design discourse, he aims to make design knowledge accessible for designers on their hands-on practice.

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