

# Designing a Card-Based Design Tool to Bridge Academic Research & Design Practice For Societal Resilience

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## ABSTRACT

Professional designers often struggle to apply insights from HCI research in their work. To make academic knowledge more accessible to practitioners, HCI researchers have created translational design tools, such as design cards, that support the translation of research insights into design practice. Prior work explored design cards for behavior change, interaction design, personal health informatics, and the sharing economy. Our work complements prior research by exploring the design and use of translational design cards for social aspects of societal resilience through a two-stage study with 14 student designers and eight professional designers. Our findings provide an empirical understanding of the design cards' generative value for incorporating research insights into the design process. Additionally, we discuss recommendations and highlight opportunities to enhance the design and use of the cards beyond societal resilience.

## CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in HCI**.

## KEYWORDS

Translational design tools, design cards, designers, societal resilience, design sprints

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## 1 INTRODUCTION

Research in Human-Computer Interaction (HCI) often provides design implications, guidelines, models, or frameworks to guide the design of products and services. Although academic research insights are informative for design [8, 63], HCI practitioners often struggle to apply research findings in their design practices [23]. Practitioners find academically oriented guidelines and frameworks too abstract, jargon-laden, inaccessible, and not detailed enough to prompt the appropriation of research insights into their workflow in industries [13, 17]. These barriers limit the impact of the work of academic researchers. Both practitioners and researchers fail to benefit from each other's skills and knowledge, creating a gap between academic research and design practice [8, 29, 55]. To bridge research and practice, HCI researchers have created translational tools (e.g., card-based design tools [16, 27], cultural probes [22], toolkits [34, 61], etc.) to support the translation of research insights into design work by making academic knowledge more accessible to designers.

Card-based design tools have received increased attention from the HCI community to articulate general research findings [19], frameworks [18], and theories [14]. Cards can easily be integrated with known design methodologies (e.g., design sprints, workshops, etc.) [14, 19] and have proven beneficial in facilitating idea generation, collaboration, reflection, and action [16, 18, 53]. The potential of succinctly communicating research insights has led to the creation of design cards for multiple contexts, such as behavior change [14, 37], interaction design [16, 43], creative game design [52], and personal health informatics [35]. Building on prior research, in this paper, we explore card-based translational tools in the context of societal resilience.

Societal resilience has long been an important research topic in social science, which has gained more attention and continues to be of interest to the HCI community due to occurrences of disasters and crises, such as the COVID-19 pandemic [69]. Societal resilience is society's capacity to anticipate, absorb, and adapt to disruptions or changes [2, 41]. Societal resilience is multi-faceted, depends on a variety of factors, such as social, economic, environmental, and political [47, 49, 54]. Because technology can play a significant role in influencing social factors to shape individuals' and communities' capabilities for enduring impacts of disruptions [12, 49, 57, 69, 74], in this paper, we focus on social dimensions of societal resilience to investigate the nature and entanglement of various social factors,

such as social relationships, social structures, social spaces, etc. HCI research exploring societal resilience provides insights to promote the holistic well-being of individuals and communities and ensure the successful navigation of change [4, 11, 46, 57]. Most research insights have been discussed only in academic papers, with less attention to applying the knowledge in practice because of the research-practice gap [23, 55, 65]. We endeavor to address this gap between academic research and design practice on the topic of societal resilience through a card-based translational tool.

In this paper, we investigate the following research questions: **(RQ1)** How can a card-based translational design tool be designed to support designers applying academic research insights to inform designs for societal resilience? and **(RQ2)** How do designers apply academic research insights in their design work using a card-based translational design tool in the context of societal resilience? To answer these questions, we conducted a two-stage study with designers. First, we conducted one-on-one design feedback sessions with 14 student designers to iteratively develop the design cards. Next, we used the finalized design cards during collaborative workshops with eight professional designers.

Findings suggest that the design cards support designers to make sense of the research insights and apply the knowledge in the design process. The work makes the following contributions to the research community. **First**, we present a card-based design tool to help designers leverage academic research insights and apply them to design for societal resilience. **Second**, we provide insights into the process of constructing a card-based design tool that can facilitate domain-specific knowledge transfer between research and practice. **Third**, we provide an empirical understanding of the cards' generative value for incorporating research insights into the design process. **Lastly**, we discuss opportunities and recommendations for the design and use of design cards on topics beyond societal resilience. These insights will inform future HCI work on translational tools to make academic research knowledge more accessible to designers. These contributions update and advance the collective knowledge of card-based translational design tools.

## 2 BACKGROUND

In this section, we first build understanding on prior work exploring the potential of design cards as a means for bridging research and practice. Next, we discuss research in HCI that focuses on building individuals' and communities' capacity for societal resilience.

### 2.1 Design Cards as a Support Tool to Bridge Research & Practice

To make research insights accessible to designers, HCI researchers have explored various design tools, such as design cards [16, 27], personas, scenarios, cultural probes [22], toolkits [34, 61], books [39], blogs, etc. Cards are popular and widely adopted by researchers to translate research insights [9, 14, 19, 35, 37]. Design cards enable the concise presentation of information and allow integration with common design methodologies adopted by designers (e.g., the design sprint) [13, 16, 19]. Design cards are designed with a various level of structure, clarity, and freedom of use [1, 32].

Cards could support and add value to various activities of practitioners' design process. For instance, the Behavior Change Cards

by Colusso et al. [14] act as reminders of theories and encourage focused brainstorming. Cards can be inspirational tools and facilitate creativity when ideation becomes "unproductive" [27, 40]. Designers use cards to plan and guide formative and heuristic evaluation of design concepts and existing systems [16, 19]. Cards facilitate collaborative practices, such as discussion, turn-taking, and the exchange of ideas among team members [21, 31, 43]. Further, design cards, such as responsible & inclusive (R&I) cards, support critical reflections on broader impacts of designs [18]. Design cards can be used in various settings, such as individual setting where freelance designers work in silos, collaborative setting with design teams, and educational setting as resources in class [32]. Translational design cards are predominantly designed as physical cards to afford flexibility of use and support actions such as grabbing, pointing, sorting, etc. [9, 16, 20, 45]. While physical cards have their benefits, card designs are not limited to the materiality of the cards as design work has been transitioning to remote and hybrid formats [72]. Despite digital cards' effectiveness, a few research work has digitized cards for translating academic research insights [18, 53]. Implementation of digital cards and their use in design practices are still a relatively underexplored area compared to their physical counterparts [18, 72]. In this paper, we are interested in understanding designers' perceptions and use of translational design cards hosted on an online collaborative platform.

HCI researchers have developed card-based tools to articulate academic research-grounded insights in various contexts, such as behavior change [14, 37], child's development [6], interaction design [16, 43], creative game design [52], nudging [9], sharing economy [19], personal health informatics [35], and technology acceptance [53]. We endeavor to extend and complement existing research of translational design cards in the context of societal resilience, focusing on supporting designers to enhance individuals' and communities' abilities in times of crisis (e.g., natural disasters, poverty, pandemic, climate change, inequality, etc.). Towards that goal, we created an initial translational design card deck and refined the cards through several iterations with student designers. We investigated how professional designers make sense of the cards' content and apply academic research insights while designing for societal resilience.

### 2.2 Societal Resilience in HCI

Societal resilience, also known as community resilience, is a characteristic of a community that determines how a community can survive and thrive when faced with adversity due to unexpected, sudden, and often hazardous situations [67]. Societal resilience is a community's capacity to (1) anticipate and prepare for social, political, and environmental change, (2) absorb and cope with negative impacts, and (3) adapt, recover, and grow from crises through purposeful and collective efforts [2, 41, 73]. The definition emphasizes bringing together individuals, groups, and organizations to withstand disturbance and bounce back from crisis [5, 38, 64].

Societal resilience has received increasing attention in social science, crisis informatics, and community research [12, 41, 51, 69]. Existing literature in HCI predominantly has explored the role of social structures and interpersonal relationships in building capacities to withstand the negative impacts of wide-scale crises, such

as wars, mass migrations, and natural disasters [12, 49, 68]. For instance, Mark et al. [49] explored how war-affected people in Iraq build a more resilient society by adapting their technology usage to reconfigure their social networks, create self-reliant communities and fault-tolerant infrastructures, and develop trustworthy information-sharing strategies. Some studies have explored societal resilience beyond crisis context [74, 77]. Vyas et al. [74] discussed that people with low socioeconomic status build resilience by sharing goods and services with their peers and community members, which can create opportunities for peer-to-peer sharing services to facilitate resilient practices.

Societal resilience is multi-faceted, encompassing closely intertwined systems, such as social, economic, infrastructure, institutional, and environmental systems [47]. To better understand the dynamic interplay of the resilience process across multiple systems, prior research adopted a multisystemic perspective [73]. The multisystemic perspective helps uncover how the resilience of one system influences the resilience of other co-occurring systems and how societies as a whole react and respond to such dependencies [26, 48, 75]. Technology plays a significant role in societal resilience, influencing a variety of social factors, such as social structure, social capital, social norms and values, social cohesion, sense of community, social support, etc. [12, 49, 57, 62, 69]. In the modern world, social aspects and technology are deeply intertwined. For instance, social relationships and connections are mediated by technologies (e.g., the Internet, social media, smartphones, etc.). HCI work has demonstrated how individuals and communities use technologies to build societal resilience during disruptions [74, 80]. In this paper, we focus on the social dimension of societal resilience. Focusing on a single dimension allows us to present characteristics of societal resilience in more detail when designing translational design cards for designers.

Existing research has explored ways to assess social factors to manage disruptions or changes in times of crisis. For example, Sharifi et al. [66] presented a resilience assessment framework identifying common features of social dimension, such as social structure, social capital, safety and wellbeing, equity and diversity, and local culture. Norris et al. [56] introduced a model to provide insights into collective capacities that shape the social process of community resilience and help a community bounce back from crisis. To explore the impact of social structures and interpersonal relationships, we proposed a framework entitled *evolving support ecology (ESE)* based on our research, which considers multiple constructs of social support to build an individual's capacity for societal resilience [57]. Existing literature explored the roles of social spaces in shaping individuals' adaptive responses to crises [3, 50]. Lyon et al. presented a three-part framework that explores the physical and social qualities of place (e.g., physical environment, sense of place, place attachment, heritage or tradition, etc.) to conceptualize the dynamics of space in informing social adaptation to crises [46].

In HCI, most societal resilience research studies on social aspects often provide insights, such as design implications, guidelines, or frameworks to guide future design. In most cases, the research knowledge is limited to academic papers and rarely applied in practice as these knowledge is less understandable to non-academics, such as design practitioners [13]. In this paper, we focus on creating a card-based translational design tool for social dimension of

societal resilience to make academic research insights accessible to designers. In addition, we explore how designers use the cards and apply research insights into practice.

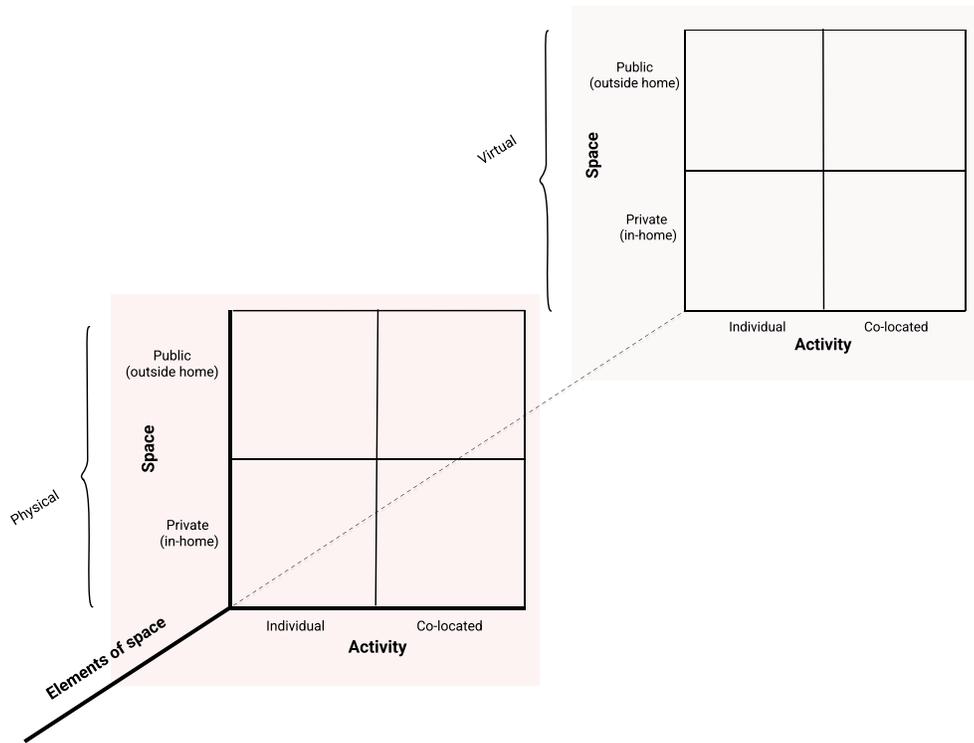
### 3 DEVELOPING TRANSLATIONAL DESIGN CARDS FOR SOCIETAL RESILIENCE

Our design goals for the translational cards were to make academic research insights about social aspects of societal resilience accessible to designers to inform, structure, guide, and inspire their activities in design process. Developing the design cards involved a thoughtful selection of relevant research insights, translation of knowledge into cards, design of card content, and identification of suitable medium.

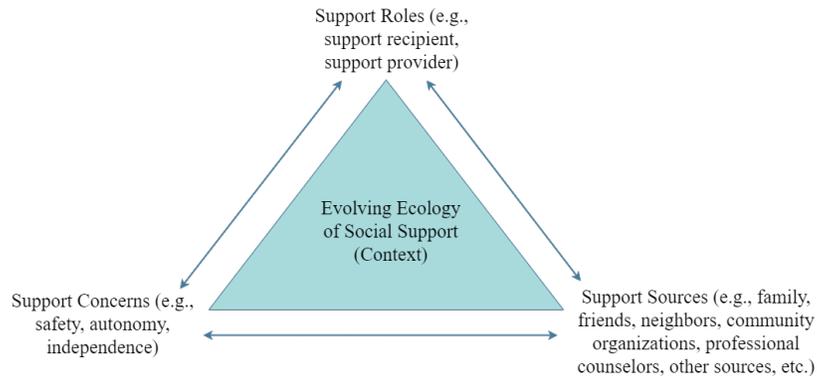
#### 3.1 Selecting Academic Research Grounded Frameworks

We created a translational tool to support designers in applying constructs of multiple frameworks exploring the social dimension of societal resilience. While selecting frameworks, our objective was to opt for those that exhibit non-overlapping constructs and effectively capture the essence and configurations of various social aspects, i.e., social structures, social factors, social connections, social support, social spaces, etc. To that end, we selected two distinct frameworks that uniquely contribute to the understanding of social dimensions of resilience. First, from our own research, we selected the Space-Activity (SA) framework [59] to explore how translational design cards prompt designers to think about spaces in their designs for societal resilience. Existing literature uncovered that people-place-activity and their social and physical interconnectivity contribute to enhancing the level of social resilience [28]. Second, drawing on literature on social resilience, we chose to focus on academic research exploring the roles of social support, which is recognized as an essential social factor to help individuals and communities cope with crisis-invoked stressors and adapt to hazardous situations [15, 25, 70]. Therefore, we selected our Evolving Support Ecology (ESE) framework for our design cards [57]. Next, we provide a brief description of these two frameworks.

**3.1.1 Space-Activity (SA) framework [59].** The framework provides a classification of spaces and activities to reflect on adaptations in response to a crisis. The framework contains three key dimensions: (1) space, (2) activity, and (3) elements of space (Fig. 1a). The space dimension is divided into public and private spaces. Home spaces are private spaces, whereas publicly accessible spaces (e.g., parks, theaters, grocery shops, etc.) are public spaces. The horizontal axis denotes the activity dimension. The activity dimension comprises individual, and co-located activities. Individual activities are performed by oneself in home and outdoor spaces, for example, grocery shopping, home exercise, etc. In-person co-located activities include social interactions and activities that people perform with others while present in the same physical space. Elements of space is divided into physical and virtual space. Virtual space contains activities performed online, such as attending memorials over Zoom and work-from-home. The framework can be used to investigate how physical and social components of a space impact



(a) Space-Activity (SA) framework [59]



(b) Evolving Support Ecology (ESE) framework [57]

**Figure 1: Selected theoretical frameworks for designing Societal Resilience Cards**

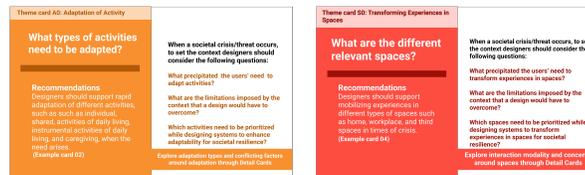
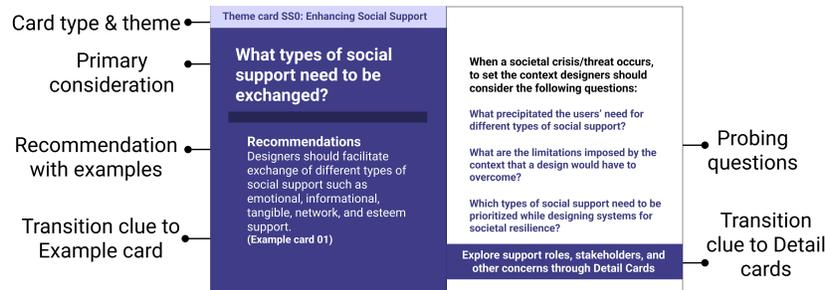
adaptation of activities and how to design new technologies to better support adaptive activities based on their spatial locations.

**3.1.2 Evolving Support Ecology (ESE) Framework [57].** The framework illustrates the evolving nature of social support in response to crisis. It comprises of three key components (Fig. 1b): (1) support roles, (2) support sources, and (3) support concerns. The support roles consider the perspectives of support providers and support recipients. The second component takes into account social, organizational, professional, and technical resources as support sources. The third element focuses on concerns, such as safety, autonomy, and independence, that impact exchange of support. The three

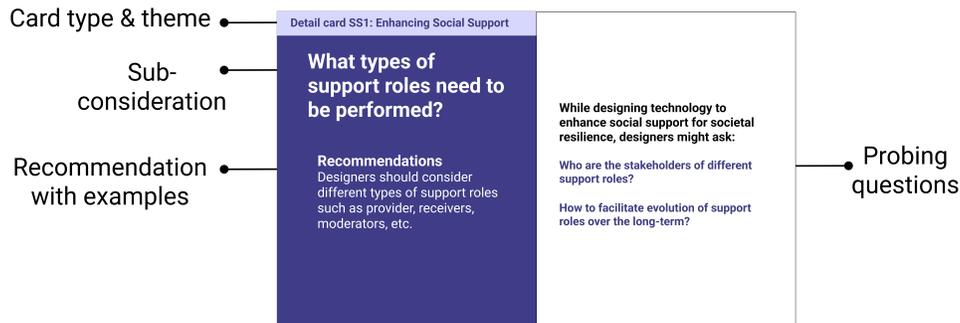
components are interconnected. For example, individuals might be concerned about their autonomy and independence when they receive support from others. Designers can use the framework to consider attributes of the three components while designing socio-technical systems for building a resilient society.

## 3.2 Transforming Frameworks into Design Cards

To transform academic research insights into design cards, we followed Sutcliffe et al.'s [71] requirements for delivering theoretical knowledge into design advice, "*the complexity of theory has to be hidden from the designers*". Presenting a simplified or streamlined



(a) Theme cards



(b) Detail card



(c) Example card

Figure 2: Overview of different types of cards

version of academic insights into design cards may expose itself to the risks of oversimplification, such as loss of important context and nuances, subjective interpretations, and misinterpretations [6, 10, 30, 31]. To balance the challenge of providing adequate information to effectively communicate comprehensive research insights without overwhelming the designers, we designed three types of cards with varying levels of detail needed to make sense of the frameworks' constructs (Fig. 2 and Fig. 3). We transformed the high-level constructs of the selected frameworks into themes of

the card deck. For instance, we divided our card deck into three themes: (1) social support, the high-level construct of the ESE framework (Fig. 1b), and (2) space and (3) activity, constructs of the SA framework (Fig. 1a). Next, we incorporated the frameworks' sub-constructs (e.g., support roles, concerns, sources, etc.) into their corresponding themes. For example, for the social support theme, there are sub-cards whose purpose was to prompt design thinking for each sub-construct of the ESE framework, i.e., support role, sources, and concerns. In addition, drawing on prior work reflecting

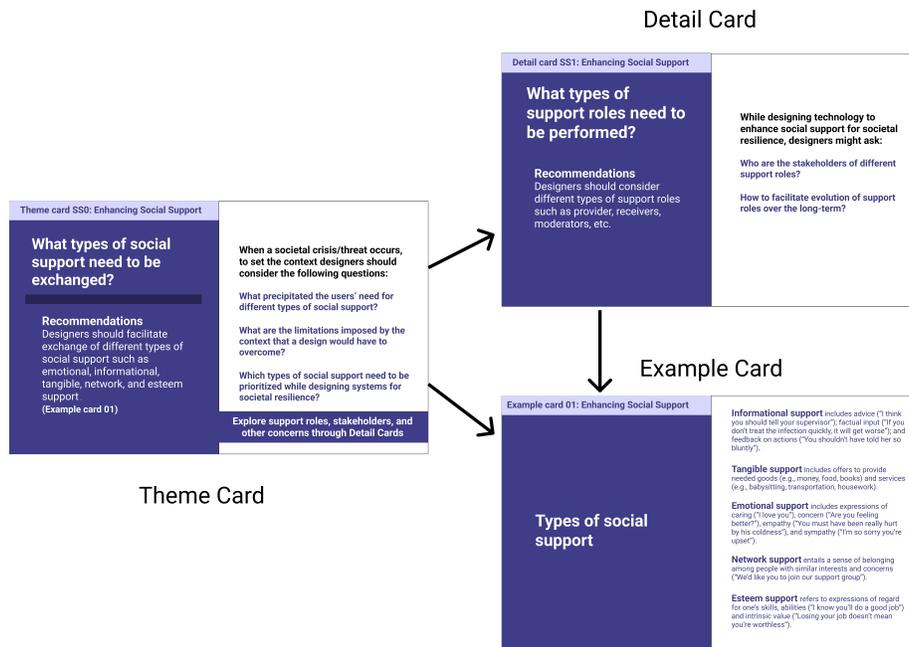


Figure 3: An overview of hierarchical structure of the card deck.

on the benefits of using examples to foster creative design practice [13, 30], we used contextual examples to illustrate the constructs and sub-constructs of the frameworks. This hierarchical structure of the card deck allowed us to preserve the depth of the frameworks in a format that is suited for the design process.

### 3.3 Developing Cards' Visual and Textual Content

To develop cards' initial visual representation and layout, we reviewed and drew inspiration from existing design cards in research and practice (e.g., IDEO cards [33], sharing economy cards [19], tango cards [16], health tracking cards [35], and behavioral change cards [14]). Our review of existing design cards revealed that the use of distinctive colors facilitates card browsing and referencing. Hence, we created three color-coded themes pertaining to social support (blue), space (orange), and activity (red).

To decide on the cards' textual content, we adapted recommendations from prior research. Colusso et al. [13] suggested translational tools should present academic information according to the commonly adopted practices in the industry, and they emphasized having a 'design challenge framing' approach. In the industry, design practitioners often frame their design challenges into questions, e.g., "How Might We...?"<sup>1</sup> question. Hence, we framed design considerations presented in the cards as thought-provoking questions. In addition, the cards included non-exhaustive lists of examples.

### 3.4 Medium for Card Deck

During the initial card development stage, the research team was iteratively developing the card content (e.g., questions, examples, design considerations) through collaborative discussions. While a

digital card deck could afford us the flexibility to continue iterating on and improving the card content, the physical format would require reprinting of the cards after each change. In addition, an online format of design cards can afford a myriad of new interactions with cards compared to their physical counterparts [18]. Hence, we were motivated to design digital cards.

We were also interested in creating a translational tool that could be scalable. We aimed at supporting collaboration among geographically distributed design teams across different time zones, which has become a more common practice, as more design practices are transitioning to hybrid and remote formats [60]. To develop our digital card deck, we used the online collaborative design tool Figma<sup>2</sup>, which allows the research team to review, annotate, and discuss various iterations of the cards collaboratively.

### 3.5 The Societal Resilience Card Deck

After iterations and discussion within the research team, we finalized a set of 16 digital cards: one Overview card, one Instruction card, three Theme cards, seven Detail cards, and four Example cards. We decided to limit the number of cards to a small number so that the designers would not feel overwhelmed [9, 24].

(1) **Theme Cards** (Fig. 2a) represent the three color-coded themes - social support (blue), space (orange), and activity (red). Each of the Theme cards introduces a primary design consideration within the theme and focuses on setting the design context. The card has six elements (Fig. 2a): (1) a title for card type and theme, (2) a primary design consideration formulated as questions, (3) a recommendation with examples as a starting point to think about the design consideration, (4) a transition clue to the Example card, (5) probing questions, and (6) a transition clue to the Detail cards. The probing questions aim to set

<sup>1</sup><https://dscout.com/people-nerds/how-might-we-statements>

<sup>2</sup><https://www.figma.com/>

the design context for the primary consideration by exploring users' needs, limitations, and priorities. Fig. 3 illustrates the hierarchical structure of the card deck.

- (2) **Detail Cards** (Fig. 2b) explore different sub-considerations for a particular theme. A Detail card contains (1) a title, (2) a sub-consideration for design, (3) a recommendation and examples, (4) a transition clue to the Example card (optional), and (5) probing questions. We identified and decided on the thought-provoking questions for each sub-considerations through a purposeful sampling of existing research on the three themes. We purposefully kept the questions open-ended to facilitate designers with varying needs, goals, and expertise.
- (3) **Example Cards** (Fig. 2c) provide elaborated contextual examples of various terms used in Theme and Detail cards. To facilitate mapping Example cards to the Theme and Detail cards, we used textual transitional clues.

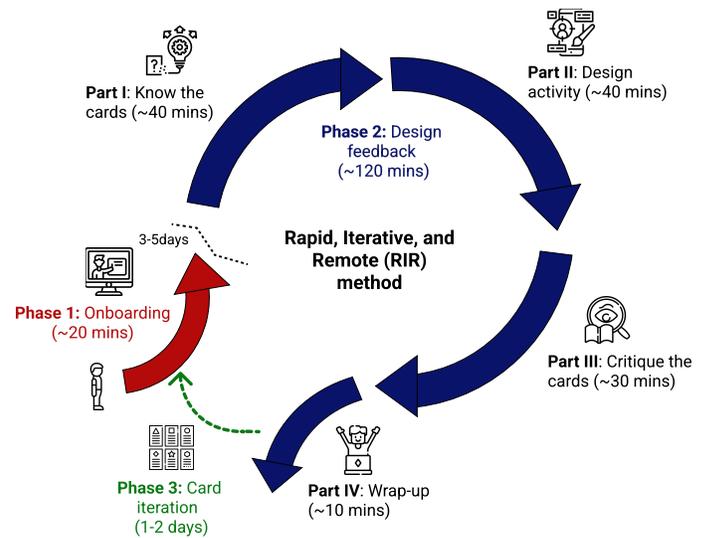
## 4 DESIGN FEEDBACK SESSION EXPLORING THE DESIGN OF CARD DECK

To address the proposed research questions, we began with a remote design feedback session with student designers. The objective is to perform rapid iterations on earlier versions of the cards based on student designers' feedback. The study was approved by the university institutional review board.

### 4.1 Method

**4.1.1 Recruitment & Participants.** To recruit design students, we disseminated recruitment materials (e.g., digital flyers, social media posts, and emails) to a student mailing list associated with universities. We also relied on a snowball sampling strategy to reach out to more potential participants. Our sample included 14 design students at a master's-level design program from three universities. Participant ages ranged from 23 to 31, with an average age of 27 years old ( $SD=2.3$ ). Three participants identified as men (21%) and 11 as women (79%). Seven participants had one or more years of industry experience, four had less than one year, and the rest had no industry experience. In addition, seven participants had experience working on design projects related to crisis informatics. Among the participants, seven had used different types of card decks (e.g., IDEO, Tarot Cards Of Tech, and UX design kit) for a design project.

**4.1.2 Procedure.** We conducted iterative remote one-on-one design feedback sessions with student designers to solicit their feedback on card content & visuals, their perceptions of how the cards can be used in the design process, and perceived opportunities and weaknesses of each version. After each design feedback session, we made changes to the design cards based on their response and feedback. We then used the most recent version of the card deck with the next participant. We continued the process until participants' responses and feedback did not trigger any significant changes to the cards. Each participant was compensated with a \$30 Amazon electronic gift card for their time. Fig. 4 illustrates the study procedure which involved three phases: (1) onboarding, (2) design feedback, and (3) card iteration. In this section, we provide a brief description of the study. A more detailed description of method and researchers' reflections on conducting the study is presented in [58].



**Figure 4: An overview of the study procedure [58]. The study involved three phases: (1) onboarding, (2) design feedback, and (3) card iteration. The design feedback session consists of 4 parts: Part I focuses on familiarizing with the cards, Part II involves a simplified design activity, Part III includes a critique session, and Part IV is the wrap-up. During the card iteration step, changes are made to the cards based on the response from the design feedback session. The most recent version of the cards is then used with the next participant.**

- (1) **Onboarding (20 minutes).** We conducted a one-on-one onboarding session over Zoom to share study procedure, resource materials (e.g., personalized Miro board<sup>3</sup> link, the card deck), and a high-level overview of the organization of our cards. The Miro board contained activity instructions and the most recent version of the card deck. To give participants time to familiarize themselves with the study content and design cards, we scheduled onboarding sessions three to five days before the phase 2, i.e., design feedback sessions.
- (2) **Design Feedback (120 minutes).** We conducted the design feedback session over Zoom and used Miro board for card interactions. We divided the session into four parts (Fig. 4). **Part I** included think-aloud activities to familiarize themselves with the deck and to get their initial reactions to the cards. We prompted participants to share their perceptions of the card structure, aesthetics, and visual design. Next, in **Part II**, we conducted a quick design activity to explore how participants used the cards for a design challenge. We crafted the design challenge inspired by real-world design problems to investigate the use of cards in addressing societal contexts of resilience. For instance, participants were prompted to explore design opportunities for socio-technical systems that allow marginalized and vulnerable populations to support themselves and their communities in times of crisis. We asked the participants to choose applicable cards and walked us through why they chose a particular card and how the selected card supported them in developing design

<sup>3</sup><https://www.miro.com/>



**Figure 5: An overview of the Evolution of the Theme card for social support theme. In Fig. 5a, the recommendation and example section are at the left side and probing questions at the right of the theme card. We swapped these content to accommodate the way participants read the card content (Fig. 5b and Fig. 5c). We undid the change in later versions when we learned that most participants did not follow the same way while reading the cards (Fig. 5d). We also included visual elements, such as icons illustrating examples (Fig. 5b, Fig. 5c, and Fig. 5d).**

ideas. Here, our goal was not to have refined design ideas for the design challenge but to understand how participants interpreted and used the cards. In **Part III**, we prompted participants to critique the cards while sharing their thoughts on the strengths, weaknesses, and opportunities for improvement. Lastly, in **Part IV**, we answered participants' queries and thanked them.

(3) **Card Iteration (1-2 days)**. We performed design iterations over the cards based on the responses from the most recent participant's design feedback session. We then used the updated card deck with the next participant during their onboarding and design feedback session.

All the sessions were recorded. During the sessions, the researcher moderating the session took notes, which were referred back to guide the changes between iterations. The recordings were transcribed for analysis. We conducted inductive thematic analysis [7] and open-coded each transcript. The codes and excerpts were discussed within the research team through synchronous meetings to identify preliminary themes, which were revised iteratively. To report the findings, we use 'DP' for design feedback participants.

## 4.2 Findings: Evolution of the Card Deck

Most revisions were focused on improving the cards' information architecture. We made a few conceptual changes to clarify the card content. We made immediate changes to the cards after a single session when a participant was confused by the language or

organization of a card. For feedback related to personal preferences, such as color schemes, we waited for additional participants to provide the same feedback. There were instances when we made a change but ended up undoing it in response to a future participant's feedback. Fig. 5 demonstrates an example of the Theme card's evolution through various design iterations.

**4.2.1 Changes to Information Architecture.** We made revisions to cards' information architecture to ensure better organization and navigation of card content. Our goal was to attain an information hierarchy that allowed the participants to scan and skim information as they needed. The revisions included changes to language and wording, the creation of transition clues, and adjustments of aesthetics & visual elements.

Participants emphasized having the cards' language simple and less verbose to invite discussions within a group. Instructional phrases, such as 'designers should consider' (Fig. 2a) and 'designers might ask' (Fig. 2b), deterred participants from engaging with the card content. For instance, DP8 mentioned having friendly language to inspire their design thinking and avoiding words such as design, designers, designing, etc., as prompts that instructed them on what to do instead of inviting reflections:

*"I feel like using the words 'design', 'designing', and 'designers' (Fig. 5a) are a bit redundant. This feels more like a pamphlet which is telling me what to do rather than*

**Table 1: Overview of the evolution of the card deck over iterations**

Iteration	Total changes <sup>a</sup>	Changes to information architecture	Conceptual changes
Iteration 1	7	Language of the questions were simplified, actionable recommendations were divided into recommendations and examples (Fig. 5b), translational clues and instructive visuals on how to use the card deck were added	New example cards were added, instructive text on ‘when to use the cards’ were included to the Instruction Card, probing questions in a Detail Card were changed
Iteration 2	5	Card content in the left and right side were swapped (Fig. 5b), wordings of the question prompts were changed, icons were added to the Instruction Card	Distinct layouts for different types of cards were designed (Fig. 5b)
Iteration 3	5	Language of recommendations was simplified, font size of all texts was changed, bullet points were added to the probing questions, bold font were used for questions	Instructive text on ‘why to use the cards’ were included to the Instruction Card, examples were provided on the Overview Card to clarify definition of societal resilience
Iteration 4	2	Icons were added to the Example Card	Image was added on Overview Card to clarify the concept of societal resilience
Iteration 5	2	Textual and graphical elements were used as translational clues	
Iteration 6	1		Instructive text on ‘why to use the cards’ were modified
Iteration 7	2	Confusing words were removed	Distinct layouts for different types of cards were re-designed (Fig. 5c)
Iteration 8	2	Words such as ‘designers’ and ‘designs’ were removed	Questions on a Detail Card were changed
Iteration 9	2	Inviting texts were added as prompts, such as ‘think about’	Distinct layouts for different types of cards were re-designed (Fig. 5d)
Iteration 10	1	Card content in the left and right side were swapped again (Fig. 5d)	
Iteration 11	1	Fonts of prompts were changed	
Iteration 12-14		No changes	
Resulting final version		A total of 18 cards: 1 Overview Card, 1 Instruction Card, 3 Theme Cards, 7 Detail Cards, and 6 Example Cards	

<sup>a</sup> The number reflects the changes made to an individual card instead of the total revisions made on the whole card deck

*inviting me to do something, I feel like (the language) should be more invitational, more friendly.” (DP8)*

In response, we changed instructive words to invitational prompts, such as ‘by asking’, ‘think about’, etc. Participants also reported that the hierarchical connection between the different cards, i.e., Theme, Detail, and Example cards, was not evident. They suggested using visual and/or textual clues to highlight transition. For instance, inspired by the design of board games, DP7 expressed adding preview images to create a visual link between the cards:

*“I’m probably biased a lot by like board games and stuff, but I do think board games have a good design system in terms of being able to really communicate with players. [...] They use visual linkage and stuff, even preview images to kind of indicate what we are looking for next.” (DP7)*

To accommodate the suggestions, we added textual prompts (e.g., go to and explore more) and preview images of the connecting cards (Fig. 5d). To ensure better skimming and scanning of information, participants provided suggestions pertinent to the aesthetics and visuals of the cards, such as typography, card title, and graphical elements. For instance, DP2 suggested adding icons to prompt thinking during the brainstorming process:

*“You can add small images, something visually appealing. Because when they (designers) are brainstorming they like to have something thought-provoking. It would be fun for them.” (DP2)*

Responding to the suggestion, we added icons to illustrate examples of the Theme and Example cards (Fig. 5d).

**4.2.2 Conceptual Changes.** Objective of conceptual changes was to make adjustments to clarify certain concepts of the cards. We made revisions that included making vivid distinctions among different types of cards, adding new cards, and modifying probing questions. For instance, we added an Example card to the deck to resolve DP1’s confusion around different terms mentioned in the Detail card:

*“I feel maybe I have no experience in this (societal resilience) kind of service design previously, so when the (Detail) card mentioned ‘provider’, ‘receiver’ and ‘moderators’ (examples of social support roles), I got a little bit confused about these three words.” (DP1)*

Table 1 provides an overview of the evolution of the cards over different iterations.<sup>4</sup>

<sup>4</sup>The complete set of finalized Societal Resilience Design Cards are available for download from the supplementary materials

## 5 COLLABORATIVE WORKSHOPS

After finalizing the cards' design through iterative design feedback sessions, we conducted two remote collaborative workshops with professional designers. The goal was to observe designers' interactions with the card deck, gather insights into designers' experiences of using the cards, and solicit their perceptions of the cards' value in the design process. The workshop protocol was approved by the authors' institutional review board.

### 5.1 Method

**5.1.1 Recruitment & Participants.** We recruited participants for the remote workshops by posting a call for volunteers in online communities of professional designers, Meetup groups, local designers' Slack/Discord channels, and Twitter, Facebook, and LinkedIn posts. We received more than 50 responses and selected six volunteers for the first workshop from that pool. While selecting the volunteers, we prioritized participants with different backgrounds (e.g., job positions, domain-specific knowledge, skills, years of industry experience, etc.). We were interested in forming groups with varied experiences to emulate design teams with diverse expertise, which are common in industry settings. Unfortunately, during the first workshop session, we witnessed some concerning behaviors from the group (e.g., turning off the video, not taking part in the individual workshop activities, not logging into the activity board, not speaking at all despite probing, unfamiliarity with typical design process & terminology, etc.), which led us to question participants' integrity as professional designers. After having a series of discussions with the research team and the university's IRB, we decided not to continue the rest of the workshop with this group. We changed our recruitment process and used convenience sampling through our personal and professional networks. We shared the study call with the university's HCI program alumni group, which allowed us to verify the volunteers' identities. In addition, we employed snowball sampling to reach out to more participants. We report this incident and our adopted approaches for transparency and usefulness for the HCI community, who might be facing similar experiences as more research shifts to online during and after the COVID-19 pandemic.

A total of eight professional designers working in different companies took part in our workshops. Participants' ages ranged from 25 to 35, with an average age of 28 years. Four participants worked as product designers, and the rest as UX designers in their respective companies. Most professional participants (N=7) had industry experience varying from 2 to 5 years. One participant had around ten years of experience. Two participants had prior experience using card-based design tools for their projects and one had previous experience in designing for crisis resilience. We used the same set of cards and did not face any issues with this group of participants.

**5.1.2 Procedure.** The eight participants were divided into groups of four for two collaborative workshops. Each workshop consisted of three 75-minute sessions (Fig. 6), and a single facilitator moderated each session. Participants were compensated with \$100 Amazon electronic gift cards. We conducted the workshops remotely using the Zoom and the Miro board.

We adopted the Google design sprint format for the workshops, since it is one of the most widely used practices among designers

in professional settings [36]. The design sprint format traditionally includes five steps: (1) map, (2) diverge, (3) decide, (4) prototype, and (5) validate. To adopt the format in a research setting, we focused on conducting four steps and removing validation or testing because it is a more complex, time-consuming task and outside the scope of the proposed research questions. In addition, we added the step **reflect** to explore participants' perspectives and reflections on applying academic research insights in practice for societal resilience.

One week prior to the workshops, we held a one-on-one onboarding session remotely with participants to walk through the workshop goal and procedure. After the session, we sent a Miro board link for the card deck and workshop activity, asking participants to familiarize themselves with the materials before convening as a group during the workshop. Fig. 6 illustrates an overview of the different steps, activities, and resources of our workshop. To understand the opportunities and holistic use of our design cards, we prompted participants to use the cards in each step of the workshop. During the workshop sessions, participants were encouraged to think-aloud, verbalize their opinions, or write their observations in the Zoom chat.

- (1) **Map (Group exercise, 35 minutes).** In the first step, participants were tasked to understand the design goal of the workshop based on input materials, such as a design brief, persona, and scenario (Fig. 7). We designed activities (e.g., creating a user journey map) to allow participants to convert the input materials into visual representations and think of opportunities for design through the process. Building upon the journey map activity, participants formulated a problem statement to focus on the specific problem space.
- (2) **Diverge (Individual exercise, 35 minutes).** In this step, participants brainstormed ideas for the formulated problem statement. To capture how participants used the cards to generate ideas for societal resilience, we asked them to annotate their ideas with design rationales and the cards used for developing those ideas.
- (3) **Decide (Group exercise, 30 minutes).** In this step, participants presented their design ideas to the group, discussed as a team to narrow down their lists of ideas, and selected one single design to create a low-fidelity prototype. To guide their decision-making, we provided a checklist ensuring that the prototype addressed the design challenge. The checklist contained design questions: (1) how does the selected design solve the persona's needs and constraints? (2) if implemented, how will the design enhance the persona's capability to promote societal resilience? and (3) if implemented, how would you measure if the design works?
- (4) **Prototype (Group exercise, 40 minutes).** Participants created a storyboard to demonstrate user interactions with their proposed solution, generated a low-fidelity prototype, and annotated the prototype with their design rationales on how the cards supported the proposed design.
- (5) **Reflect (Group exercise, 75 minutes).** In this final step, we held a focus group discussion to solicit participants' attitudes towards the workshop activities, design cards, and their reflections on how the deck supported them during their design process for societal resilience. Participants discussed their experiences

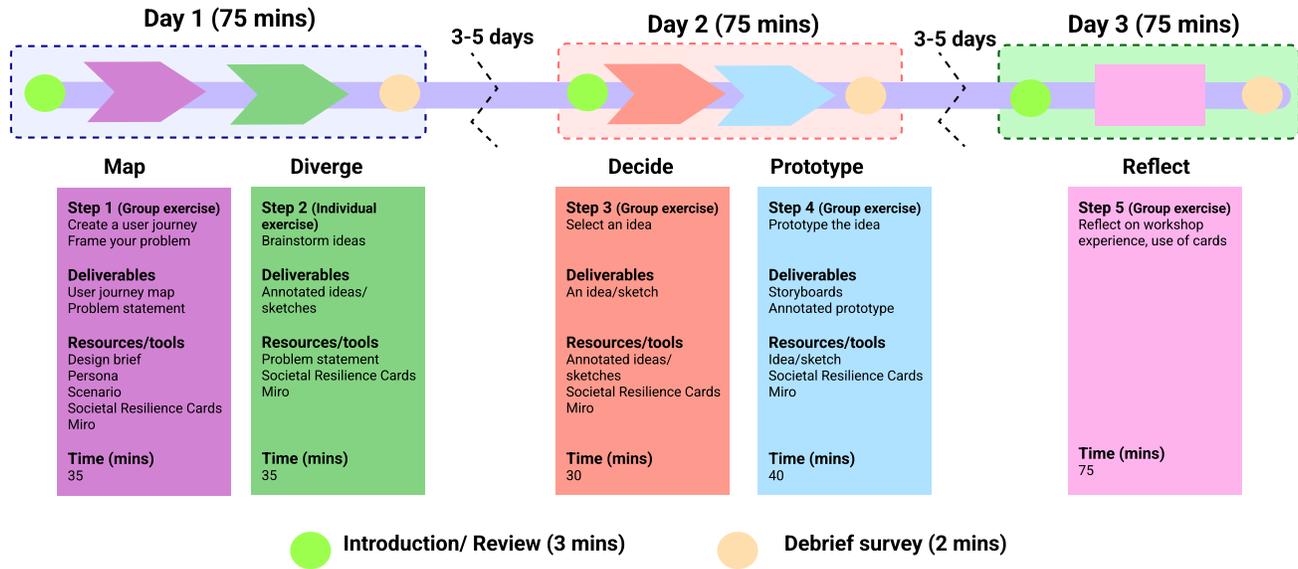


Figure 6: An overview of the design sprint workshop’s 5 steps: (1) map, (2) diverge, (3) decide, (4) prototype, and (5) reflect

<p><b>Design brief</b></p> <p><b>Design challenge:</b> Support older adults to contribute and help their community in times of crisis (e.g., pandemics, natural disasters, poverty, etc.), and do that in public spaces without being stuck at home.</p> <p><b>Client:</b> Major technology research lab who are looking into designing systems to build societal resilience for future crisis.</p> <p><b>Deliverables:</b> Prototypes of socio-technical support systems.</p>	<p><b>Persona</b></p> <p><b>Ann Smith</b></p> <p>Age: 72 Gender: Female Race: African American Relationship Status: Widowed Living Situation: Lives alone Income Level: Mid Education: Graduate degree</p> <p><b>Technology expertise</b></p> <p>Laptop ✓ Desktop ✓ Smartphone ✓</p> <p><b>Activities</b></p> <p>Socialize Volunteer Walk Family</p> <p>"I love living in the community and try my best to support the community in various ways."</p>	<p><b>Scenario</b></p> <p>Ann spends most of her time volunteering in various social activities and providing social support to her peers, neighbors, and community. For instance, she helps older and home bound peers through activities, such as checking on them, exercising together, and getting their groceries. She finds that being able to make contributions to her community is crucial to her mental well-being, sense of purpose and dignity.</p> <p>However, Ann stops participating in in-person social activities in the community because of the COVID-19 pandemic. These make her feel more isolated and disconnected from the community. The only way she has been able to continue her community interactions is over Zoom while joining from her living room. She is unhappy being stuck at home all the time and interacting with people only on a screen of small squares. Ann wishes she could help her community, which she can see is suffering during the crisis. She is frustrated that she cannot figure out how to tap into her skills, time, and willingness to help others with all of the pandemic restrictions.</p>
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Figure 7: An overview of resources: design brief, persona, and scenario

of using the cards and shared opinions about opportunities of the cards.

5.1.3 *Analysis.* We recorded (audio and video) and transcribed all the sessions of the collaborative workshops for analysis. Following Braun and Clarke’s approach [7], we conducted an inductive thematic analysis of workshop transcripts. The first author open-coded each transcript and discussed the codes and excerpts within the research team to identify emerging themes. The initial themes reflected participants’ perspectives on card-based design tools, their utility to bridge academic research and design practice for societal resilience, and perceived opportunities of the card deck. The research team iteratively reviewed, revised and refined the themes through synchronous meetings. We used the open-source software Saturateapp<sup>5</sup> to facilitate collaborative qualitative analysis. To report the findings, we use ‘WP’ referring workshop participants.

## 6 FINDINGS

Our findings from the collaborative workshops reflect how the design cards supported participants to apply academic research insights into their design process while designing for societal resilience. We begin by discussing participants’ reflections on the

<sup>5</sup><http://www.saturateapp.com/>

cards. Next, we explore the adoption of the design cards and report their utility for societal resilience design. We discuss opportunities for the design cards.

### 6.1 Perceptions of the Design Cards

Our participants reflected on how different aspects of our translational design cards provided them a means of connecting and applying academic research insights in the context of design. They outlined the value of card constructs (e.g., examples and questions) in prompting their thinking process and identifying underexplored perspectives of the societal resilience problem space. Participants often devised their own mental hierarchy of cards. In addition, participants discussed the perceived value of using a digital format of cards shared on online collaborative platforms.

*Constructs of Cards.* Participants reported that examples helped them clarify specific terms, understand the problem space better, and inspired them to explore design opportunities for societal resilience. In addition, the examples gave them a starting point and prompted participants to consider missing and unanticipated design issues and perspectives. For instance, WP7 described that the examples helped her to develop initial knowledge and verify her assumptions about the design space of societal resilience:

*“I feel the examples are pretty straightforward. It’s a very quick way for me as a person who was not familiar with the topic (societal resilience) to quickly get some pre-knowledge and then build a shared understanding with my team. [...] As I am not sure if I have the correct assumptions (about the problem space), the examples help me double verify some of my thoughts. [...] When I don’t have any ideas, I go back to the Example cards to see if they are any missing opportunities.” (WP7)*

While describing their perspectives on questions, participants appreciated having the question format instead of descriptive text. Most participants liked the open-endedness of the questions, which provoked them to think and reflect on multiple aspects of the societal resilience problem domain (e.g., use cases, edge cases, limitations, etc.) and triggered a wide range of discussions and meaningful dialogues within the design team. For instance, WP4 shared how the questions in the cards empowered the designers to break out of their perspectives and consider fresh and holistic perspectives while exploring design opportunities for societal resilience:

*“I do feel the questions in the cards provoke thinking. When designers are thinking, instead of just looking at fixed concepts from their existing perspectives, it (the questions) helps to give them a fresher viewpoint to look at everyone (the users) involved in the process. [...] It’s (the questions) kind of like a shortcut to enable them (designers) to see a lot of things from many perspectives in a very short amount of time.” (WP4)*

**Flow of Cards.** The cards in the deck had an ordered structure where the Theme Cards contained prompts for the Detail Cards and Example Cards (mentioned in Section 3). Although the card deck included a hierarchical order (Fig. 3), we did not prescribe or force participants to follow any order while engaging with cards. We found that participants devised their own mental models and hierarchy when they used the cards in their design process. For instance, WP7 described she did not follow any ordering and jumped between different cards to get support during the design process:

*“There’s no fixed sequence to read the cards because I remember when I start reading, I actually start with the Example Cards first, they are very easy to understand, and then I go back to the Theme Card to learn the overview of aspects like social support. And later, when I was blocked, I checked the Detail Cards. So for me, I jumped between the different types of cards.” (WP7)*

In addition, participants appreciated the information hierarchy design of the cards. They described that the information hierarchy let them skim the cards and scan the needed information effortlessly. For instance, WP1 reported that the headings of different card components made it easy to locate the information needed for the design process:

*“For me, it (the card) has a good information architecture. It’s very easy for me to scan or search the keyword that I want to find, because of the title or headline for each of these (components). [...] if I want to look at the detail it’s very easy for me to locate the information. So I think the layout is good.” (WP1)*

**Mediums of Cards.** Although participants used the cards in digital format during the study, they described the utility of using cards in physical and digital formats. The main motivation participants described for using the physical card deck in their design process was the tangibility of physical mediums. They highlighted that laying the cards on the table and holding them in their hands led to more engagement with the cards, especially when working with team members. For instance, WP3 expressed her desire to print the cards in handheld size to facilitate switching between cards of various themes:

*“I’m actually imagining it (the cards) being a printed, you know, physical cards right on my desk because it looks like it’s also being designed into a handheld size. I can quickly just switch in between (themes). Also, I like the color code, so I know which direction or which like big, high, level categories (themes) that I go to only by looking at the colors.” (WP3)*

Participants described that digital cards afforded diverse interactions with the cards, such as integration of notes, ideas, rationale, and prototypes, which could add more value to their design process in the context of the COVID-19 pandemic-invoked changes in workplaces and work practices (e.g., online meetings). In addition, participants discussed how the digital format could afford the flexibility to continue iterating the card content (e.g., themes, examples, and guiding questions). For instance, WP3 pointed out that digital cards allowed the opportunity to continue updating the card deck to reflect emerging contexts, issues, and users’ needs for building societal resilience:

*“One good point about having digital cards is that you can keep updated. [...] For example, maybe inflation not used to be a huge factor considering two years ago. Now, it is a thing that you should consider in examples (for societal resilience). [...] It is a good opportunity for you to just keep it (digital format), and make sure it’s (the card deck) all up to date.” (WP3)*

## 6.2 Uses of Design Cards in Practice

Participants discussed how they used the card deck and how the cards helped them in the design process. Table 2 elicits a distribution of cards used by the participants across four steps of the design sprint. We found that participants were motivated using the cards in the early stages of the design process, i.e., map and diverge. In contrast, they used fewer cards during prototyping. As a potential reason, WP4 expressed that while creating prototypes, they already applied card content to devise a well-defined problem statement and a high-level design solution:

*“At this point (during prototyping), we are pretty informed by what the cards have to offer. The information from the cards has already been kind of baked into what we’re trying to create, what we’re thinking of behind this entire prototype, and our design rationale. So I guess for me that’s one of the reasons why I wasn’t using the cards.” (WP4)*

Building on workshop participants’ reflections and their interactions with cards, we identified four areas the cards support, which

**Table 2: Number of Theme, Detail, and Example cards are used in collaborative workshops**

Workshop steps	Workshops	Total (N=16)	Social support			Activities			Spaces		
			Theme (N=1)	Detail (N=3)	Example (N=3)	Theme (N=1)	Detail (N=2)	Example (N=2)	Theme (N=1)	Detail (N=2)	Example (N=1)
Map	CW1	7	—	1	3	—	—	1	—	1	1
	CW2	6	1	—	2	1	—	2	—	—	—
Diverge	CW1	9	1	—	2	1	2	—	1	2	—
	CW2	14	1	3	3	—	2	2	—	2	1
Decide	CW1	1	—	1	—	—	—	—	—	—	—
	CW2	2	—	1	—	—	—	—	—	1	—
Prototype	CW1	1	—	1	—	—	—	—	—	—	—
	CW2	1	—	—	1	—	—	—	—	—	—

CW1= Collaborative workshop 1  
 CW2= Collaborative workshop 2

can spread across one or more than one workshop steps presented in Table 2. The areas are: (1) understanding the problem space (map), (2) brainstorming (diverge), (3) evaluating & revisiting (diverge and decide), and (4) communicating & advocating (diverge and decide).

**Understanding the Problem Space.** Participants described that the cards helped them explore and contextualize the problem space. The cards supported participants in structuring primary research for an unfamiliar domain of societal resilience to understand the stakeholders and inform their design decisions. For instance, WP2 was not very familiar with the design space of societal resilience and envisioned using the cards as a guiding tool to prepare interview guides for user research:

*“I’m not very familiar with the space (of societal resilience) and looking at a card provides me with some of the contexts on what other things I need to consider. For example, I mainly use the example cards that talked about users’ support concerns, which are autonomy, independence, etc., [...] If I have not worked in the relevant space, I may not have thought of all those aspects. I’ll use these probes, more like a guiding tool for me to prepare for the questions, [...] to ask questions during user interviews, [...] formalize my thoughts.” (WP2)*

The cards facilitated participants to converge and define which problem to solve. Participants used the card content (e.g., questions and examples) as a ‘checklist’ to narrow down key stakeholders, aspects, pain points, and design directions for design. For instance, WP3 described that the cards provided a structured way to identify specific problems and opportunities where they could spend their time and effort during the collaborative workshop:

*“As a designer, there are so many things we can work on. But how do we decide where should we put our time and energy? With the design card, it just provides a structured way for us to evaluate each approach and direction we are going to work on. [...] the design card is able to help me to prioritize the most effective thing we can think of [...] and then later on, we just work on that.” (WP3)*

**Brainstorming.** Participants described that card components, such as icons, words, examples, and questions, helped them to start their brainstorming process. They reflected upon the content of not only

individual cards but also combinations of cards to facilitate ideation process. For instance, WP4 shared that different parts of the cards offered inspiration to initiate brainstorming, and she often connected content from multiple cards for insights during ideation:

*“When you are trying to think of ideas, you’re kind of like “oh, I have this entire problem space but where do I start?” One thing I found very inspiring about the cards that have short phrases (in the Theme card), little icons, [...] they really served as kind of like a starter [...] say nuggets in the thinking. [...] I found myself kind of naturally started using multiple cards together. I was using like this thing from this card, and then that thing from the other card. That’s how they supported the formation of the ‘Chef of the Day’ idea.” (WP4)*

The cards also supported the design ideation by allowing participants to diverge from their unidirectional thinking while revealing domain-specific issues they may not be aware of or consider when devising ideas. For instance, WP7 described that the cards helped her to explore holistic aspects of the problem space instead of being stuck with one-directional thinking while generating design ideas:

*“First I’m thinking about a location-based community app that help users (the persona) to post what they need and also get providers to help. [...] and when I look at the card, I know there is a support role called ‘moderators’, and I wasn’t thinking about that before. I do think that moderators will be necessary to support the groups and also solve any safety issues.” (WP7)*

**Evaluating & Revisiting.** Participants expressed that the cards could be used as a guiding tool to evaluate existing solutions designed to support societal resilience. For instance, WP7 explained that the cards could be utilized as Nielsen’s usability heuristics<sup>6</sup> to measure the success of a product:

*“The cards can also be used as success criteria to evaluate a product. It will work like the heuristic evaluation principles by Nielsen. [...] for cards, it’s like 3 different principles (indicating detailed cards for support roles, concerns, and sources) to evaluate social support app. Let’s say, there is an app that helps other people to enjoy*

<sup>6</sup><https://www.uconn.edu/2015/02/10-heuristic-principles-jakob-nielsens.html>

*the virtual community, and then we can use the cards (the social support cards) to evaluate the app from different perspectives. [...] So there is a heuristic evaluation criterion.” (WP7)*

The cards could be used as a checklist to re-evaluate assumptions and designs after the first round of ideation. Participants shared that the cards supported them in revisiting their design decisions to include unanticipated perspectives and edge cases. For instance, WP3 found the questions on the cards could help to iterate over the initial designs:

*“In a more realistic working environment, design itself, there’s not any end points, it’s like unlimited. [...] As a designer, much of the time is being used on iterations, like when we come back to the ideas and try to improve it. On the Detail Cards, the questions on “how this change over the long term”, this could be a very great prompt for the iterations.” (WP3)*

**Communicating & Advocating.** Participants thought the cards could be beneficial in communicating their designs to others involved in the design process (e.g., designers, project managers, and stakeholders). The cards create a glossary of domain-specific terms to articulate ideas and build shared understandings among team members. For instance, WP6 discussed that the cards formed a common language to comprehend what other team members were referring to by specific terms during design discussions:

*“From the nomenclature side, when there is a new project, people will call one thing by different names. This card will help a group of people to understand what is what and we’ll call those things the same name. [...] for example, this (the social support role card) talked about the roles as providers, receivers, and moderators. When we mention those roles, we get immediately what our teammate is saying.” (WP6)*

Participants discussed using the cards to advocate for their design decisions. For instance, WP7 envisioned using the cards as evidence to make arguments for her designs to support decision-making in the design cycle:

*“In our daily job, my team talks about high-level solutions very frequently. Because we are doing some exploratory designs and the problem is very vague. So, if we have 10 different directions at the beginning, we can’t really make prototypes for all of them. We may refer back to the cards as evidence to argue with my teammates when we just have different opinions and the team tries to align.” (WP7)*

### 6.3 Effectiveness of Design Cards

Participants discussed that the cards extracted and compiled research insights on their behalf and they could jump into ideation, which saved their time. We observed that participants used the cards to reflect on and embed constructs of the frameworks (Fig. 1b and Fig. 1a) in their decisions while developing design solutions or functionalities for societal resilience. For instance, WP3 elaborated that the space cards, which translated the Space-Activity (SA) framework, exposed her to think about different types of physical

spaces and how the physical space plays a role in designing users’ activities at home and public spaces for building societal resilience:

*“I like the space cards, designing something for experiences outside my computer, [...] Maybe the user’s (persona) activity can not only happen in their own home. It can happen on public transportation, or it can happen online with all kinds of possibilities. It is finally refreshing for me to think about, which is also the point of having cards adopt a framework. It just reminds me of something that you’re not quite familiar with.” (WP3)*

During the workshop, we observed that participants used the card deck to develop various design ideas for building societal resilience. Most of the design ideas by participants were related to social interactions, particularly for creating social relations with community members and developing a sense of community to foster collaborative support for societal resilience. For instance, WP4 illustrated how the cards motivated her to generate utility-focused solutions or services to support users’ experiences instead of customer-facing designs. She proposed a design concept, *Chef of the Day*, a community-based meal service that would allow local community members to volunteer for tasks, such as grocery shopping, grocery delivery, meal preparing, and meal delivery, to build community connection through food.

In addition, the card deck also helped the participants incorporate features or functionalities to support opportunities and changes over the long term. For instance, WP6 proposed the design concept of an online platform that would facilitate the exchange of support among community members, and she talked about how the cards prompted her to be mindful and consider long-term assistance to build capacity for societal resilience:

*“I think the support concern card (detail card), there are some issues like safety, autonomy, independence, timeliness, duration, relationship, and personality. [...] the detail card, I think it inspired me of think like the change in user supports roles over the long term. [...] So, I was thinking, after giving support, there might be something we need to work on making sure the support is good for the future or set up some kind of opportunities, like future time for the two people to give and receive support again.” (WP6)*

Collectively, these reflections illustrate the cards’ effectiveness in informing designs for societal resilience. Table 3 summarizes the design ideas developed by the participants during the workshops, along with the respective cards used to generate those ideas.

### 6.4 Opportunities of Design Cards

Participants discussed other opportunities to elaborate on the utility of the design cards. They appreciated the value of design cards as a *resource* for designers. The cards introduced participant to resilience-specific considerations and prompted them to think about the factors presented in the cards for societal resilience. For instance, WP1 used a metaphor describing how the design cards support prioritizing information to inform designers:

**Table 3: An overview of design ideas developed during workshops and the card theme used in ideas**

Design idea	Description	Cards used in those ideas		
		Social support	Activities	Spaces
Community platform	An online platform that would allow community members to request, provide, moderate different services, such as caregiving, grocery shopping, etc.	✓		✓
Daily check-in	An application for older adults to perform daily check-in and video chat with their peers	✓	✓	
Social meetup	An online platform to support virtual gatherings for social activities, e.g., watching movies/concerts, book clubs, etc.	✓	✓	
Caregiving support	A collaborative platform for caregivers to help each other based on their ability and availability	✓	✓	
Accessing community space	A location-based application to notify community members about the availability of community spaces, e.g., gym access		✓	✓
Tangible resource sharing	An online platform where people can post request for tangible goods, e.g., phone, cloths, book, etc., and other people who have those goods can respond to the request	✓	✓	
Chef of the Day	A community-based meal service for community members to volunteer for grocery shopping, grocery delivery, meal preparation, cooking, and meal delivery	✓	✓	
Health diary	A platform where users, particularly older adults can post their daily health status and conditions and share those information with close friends, neighbors, family members, and medical professionals	✓		
Photo sharing	A photo sharing platform where neighbors can share photos of their daily activities to build a sense of community		✓	
Support exchange	A web-based platform to help exchange of informational, emotional, and tangible support	✓		✓
CareShare*	A community child care platform for child care support for parents working from home and community members can respond to support requests based on their schedule and availability of space at their home	✓		✓
Community delivery	A service where home-bound residents can call a community rider to help delivery necessary items within the community	✓		
Community game	A social simulation online community game where community players can perform different collaborative activities online, e.g., fishing, visiting friends, fruit picking, etc.		✓	
CatBot*	A cat-shaped companion robot that collects health data (e.g., heart rate, body temperature, pulse rate, etc.) from wearable devices and facilitate community care while searching people from the neighborhood who would be willing to help	✓	✓	✓
Exchange diary	A service where community members maintained a shared notebook to write down their thoughts and comments and share the notebook within their peer group	✓		

\* Design ideas selected for creating low-fidelity prototypes during the collaborative workshops

*“Tell me if my metaphor can make sense. I’m thinking about library, or Google search results. There are millions of results being included in a (search) pool. But as a designer, you know that not all of the information will be important right away. [...] who can find out or prioritize from all these results. So your tool (design cards) is more like a machine learning process, help them (designers) to personalize this library to make sure this library can fit them the most.” (WP3)*

Participants suggested alternative users of the cards other than designers. They shared that cards’ strategic guidelines could be helpful for the company’s stakeholders, such as c-suite project managers, directors, etc., who held more control and decision-making power in the design process of industrial products compared to the designers. Participants saw opportunities for the design cards to be used by local community members and organizations to build societal resilience because they knew the community’s needs and constraints better than the designers. For instance, WP3 described introducing the cards to the community members to empower community-driven designs:

*“All these resources and guidelines design cards are providing, we try to introduce that to community members and let them self-help, only the community themselves know what’s the best way for them. [...] We use our professions to help them to get started with the cards, make it easier for them to work around with it. [...] They can*

*start to do their explorations with the part that they are good at.” (WP3)*

To facilitate card use by non-designer audiences, participants suggested ways to reduce the learning curve for the cards. For instance, WP3 suggested having an onboarding session to provide an overview of the cards:

*“I personally found that (the onboarding presentation provided during the study) really helpful, without talking details I got a brief overview of what the card is about. So, I will say it will be great if you can document such a brief overview in a way, so they (other users of cards) know, which cards to dive in.” (WP3)*

Although the participants used the card deck to design for social aspects of societal resilience in a crisis context, i.e., the COVID-19 pandemic, they discussed other contexts and problem spaces of societal resilience beyond crisis situations where they envisioned using the cards. Participants anticipated the cards could help design community-driven solutions for societal issues, such as the consequences of inequality, homelessness, and stigma. For instance, WP6 reflected on her prior project on homelessness and discussed using the design cards, particularly the social support cards, to design for such social problems:

*“I was working with a nonprofit organization before, and they are designing an app to help people with homelessness situation. I think this card (deck) may apply to*

*that situation because a volunteer who is a user of that app may want to provide some kind of social support to homeless people. We could use these social support cards. I can imagine understanding some of our users' concerns, I mean homeless people's concerns, and also better support them in different ways.” (WP6)*

In summary, participants reflected on the value of the cards as a resource tool that built and expanded their understanding of societal resilience. They described the potential of the cards for alternative users, such as community members, project managers, etc. In addition, participants envisioned using the cards to facilitate design for contexts beyond crisis.

## 7 DISCUSSION

The findings illustrate how designers make sense of research insights embedded in translational design cards and apply academic knowledge while designing for societal resilience. We reflect on the generative value of the design cards for incorporating research insights in the design process. Next, we explore means for extending the design cards to accommodate new research insights. Lastly, we discuss recommendations informing the design and use of translational design cards.

### 7.1 Effectiveness of the Design Cards as Translational Tools

Our findings revealed that the design cards are effective as translational tools. The thematic and hierarchical structure of the design cards (Section 3.2) suggests how the cards are related, which guides the participants to start the creative design process and apply research insights in designs for societal resilience. Participants used the cards to build a shared understanding of various terms, navigate design discussions, advocate for their design solutions, and perform design iterations. We found that the cards helped participants scope down the design space of societal resilience and supported them to focus on spending their time and effort to attend the workshop's design goal. In addition, findings revealed that the cards inspired designers' creative thinking and provided the freedom to explore out-of-the-box design opportunities by providing open-ended probing questions, examples, and visuals to spark ideas. The design cards impacted designers' values, sensitizing them towards designing utility-focused solutions or services (Table 3). The open-ended card content (i.e., questions and examples) helped designers unpack additional issues, such as sustainability to support long-term use.

Prior work by Aarts et al. reported that designers preferred using cards having a prominent structure or hierarchy as those cards ensure clarity of use [1]. In contrast to this observation, we found our participants developed their own hierarchical order to use the design cards. For instance, one participant mentioned that she did not follow a sequence while using the cards in the design process, and she jumped between Theme, Detail, and Example cards to best suit her needs. Designers preferred having freedom of use while using a design tool in their design process [78]. However, if a card deck provides absolute freedom with no concrete structure to guide the card use, designers may feel lost in what to do with the cards and refrain from using them.

Freedom of use may introduce subjective interpretations of theoretical knowledge when using translational design cards [6, 10, 31]. Although subjective interpretations allow designers to apply scholarly knowledge in different ways in their design process without restrictions, they can also lead to misinterpretation [30]. Whereas concrete guidance for card use and a more strict structure often can be considered leading, restricting designers' expressiveness and creativity while designing for a multi-faceted design space of societal resilience. To overcome the tensions between guidance and freedom, there is a need to strike a balance between them.

We took three approaches to balance guidance and freedom. **First**, the card deck contains two additional cards (e.g., Overview card and Instruction card) to guide the process of using the design cards. Prior work suggested paying equal attention to design usage guidelines and card content to ensure cards' utility as a design tool for communicating research knowledge to designers [1, 18, 79]. We deliberately decided to provide suggestions for use rather than specific instructions as usage guidelines. We went through several iterations with student designers to explore what information to provide, how much information to provide, how to organize them to clearly, and how the embedded knowledge can be used to support the design process (Table 1). **Second**, we used visual and textual clues to demonstrate the hierarchical structure of the deck (Fig. 5d). These clues for transition serve as a subtle reminder of how to use the cards. **Lastly**, we purposefully kept the card constructs, i.e., probing questions and examples, open-ended so that designers can appropriate the design cards based on their needs and goals. These approaches collectively helped participants structure and constrain design process without restricting their freedom and expressions.

### 7.2 Exploring Extensibility of the Translational Design Cards

Findings suggested that the themes (e.g., social support) covered in our design cards are broad and can be applied to various contexts of societal resilience beyond crises, such as societal issues, sustainability, etc. The open-endedness of the probing questions and examples allowed designers to appropriate the design cards for different user groups. For example, participants shared that the guiding questions for social support roles and concerns can be applied across diverse user groups even though a user's needs and priority may change based on the persona or design goal. In addition, we found that participants combined constructs from multiple frameworks in their designs (Table 3). These findings suggest exploring the extensibility of the translational cards to account for various contexts, user groups, new theories, and emerging perspectives.

While designing translational design cards, researchers often assign one card to represent a single construct or insight from a theory/framework to accommodate multiple theories/frameworks in the card deck [14, 53]. For instance, Colusso et al. translated eight behavior change theories into design cards where each card focused on a single construct from a theory [14]. Although this approach allows designers to apply multiple theories in design, the card content is limited in depth to ensure that designers are not overwhelmed with too much information. Furthermore, designers often struggle to apply research insights that are complex and have multiple constructs without a more prominent card structure [1, 14].

We went through a three-step approach to structure the translational design cards: (1) we transformed the high-level constructs of the frameworks into primary design considerations or themes for the Theme cards (Fig. 2a), (2) we translated the sub-constructs into sub-considerations and presented them as questions in the Detail cards (Fig. 2b), and (3) we illustrated constructs and sub-constructs with non-technical contextual examples from related academic research findings in Example cards (Fig. 2c). This approach allows representing framework constructs in detail across multiple cards, balancing the level of detail needed to make sense of the constructs without overwhelming the designers, and enabling in-depth engagement with academic knowledge for design.

In addition, our adopted approach has the potential to overcome barriers that limit the use of design cards in practice. Prior research reported that the abundance of cards designed with various levels of structure, clarity, formats, and usage guidance make it challenging for designers to use them in the design process [1, 32]. If more HCI researchers use the proposed structure to create translational design cards, designers may become more familiar with the cards' format and use them effectively in their design process.

Although the HCI community strives to promote and contribute new knowledge creation [76], Wölfel et al. reported tensions around creating new design cards [78]. If a new design card deck is created, they need to account for customization to ensure lasting use by the designers. Furthermore, if designers fail to integrate the new cards into their workflow, they may not continue using them in practice [13]. Our approach of translating research insights into design cards provides a repeatable card structure (themes, questions, examples) while still offering flexibility to accommodate new research insights. The repeatable structure simplifies the card creation process as the researchers do not have to design from scratch. Therefore, we encourage HCI researchers to adopt the structure when designing new translational design cards. If created using similar structures and formats, new decks can easily be combined for design work informed by a specific set of theories, frameworks, and other research contributions. Our findings suggested that the cards' structure and format helped participants to apply constructs from multiple frameworks in their designs for social aspects of societal resilience (Table 3). The modular approach of translating research insights into design cards can support the integration of different academic knowledge in a single deck without compromising the level of detail needed to make sense of the cards' content, making the card deck extensible to accommodate new and emerging research insights.

### 7.3 Informing Card-based Translational Tool Design and Use

Building upon our findings, we also see opportunities and provide recommendations for the design and use of cards in other design contexts. These insights will inform how to enhance card design and use beyond the societal resilience context, advance collective knowledge, and open up new directions for future HCI work on translational tools.

*Card Content.* Prior research reported that despite cards' utility in communicating research knowledge and supporting trends in design, cards are not used extensively in design practice [32]. Due

to a lack of structural support in making sense of cards' content, designers may not perceive cards' utility in their work and struggle to make informed choices when selecting design cards [1, 32, 78]. To address this barrier, card content should be designed so that the embedded knowledge of the cards can support the design process.

Existing research adopted sensitizing questions [31, 52], quotes [35], visual examples [19], and textual and graphical descriptions [6] for design cards to effectively communicate academic knowledge. We used open-ended questions and textual and visual examples in our translational design cards. Participants appreciated the questions because they were similar to the 'how might we' questions commonly used in their practice. Additionally, participants liked the contextual examples because they clarified research insights and inspired them to explore design opportunities for social dimensions of societal resilience.

Based on our findings, we encourage keeping questions and examples deliberately open-ended to initiate thinking and invite discussions. The questions should be designed to connect the research insights (e.g., framework's constructs) with the design context. In addition, we encourage crafting questions that probe designers to think beyond the design context for research insights. For example, asking questions on types of resources or support needed to account for changes in the long-term.

*Card Medium.* Existing research reported the effectiveness of physical cards in promoting creativity and triggering collaboration [44]. The tangibility of cards makes it easy to spread them on a surface to get an overview, which affords fluent interactions with cards, such as grabbing, pointing, grouping, and sorting [16, 42, 45]. However, physical cards do not work well for remote or hybrid design teams [72].

Although participants acknowledged the value of the physicality of physical cards, they highlighted opportunities for digital cards. We implemented the design cards in Miro, which afforded various new interactions with the cards. For instance, participants made copies of the cards, annotated cards with their notes, ideas, design rationale, and prototypes, as well as used the zoom-in and out feature to navigate specific cards and focus on the content in more detail. Further, the digital format increases the accessibility of card decks while creating opportunities for online collaboration with design teams [72].

We acknowledge the utility of physical cards and certainly do not suggest replacing physical cards with digital ones. Instead, we recommend being mindful of different affordances, strengths, and weaknesses of physical and digital cards that can influence card use and interactions. For instance, digital cards can be beneficial when a design team wants to record the progression of their creative journey, such as their notes, design ideas, use of design tools, design rationales, and overall design process.

*Card Audiences.* Participants pointed out alternative users of design cards besides designers, such as project managers, project directors, c-suite executives, etc. They felt the cards could support advocating for their designs and communicating rationale with business stakeholders in industry settings. Further, participants envisioned using the cards with local community members in community settings, such as participatory design. The cards' format and the iterative card design process (Fig. 4) help simplify complex

and abstract research insights, making the cards more accessible to a broader audience.

While creating translational design cards, we encourage considering alternative users [32], such as project managers, multidisciplinary stakeholders, community members, etc. In addition, we see opportunities for future work to explore what additional resource and support is needed to facilitate card use by broader audiences. For example, extending our onboarding sessions that share the card deck with participants can be one approach to walk alternative users through card use with hands-on examples.

## 8 LIMITATIONS & FUTURE WORK

This work has a few limitations that can be addressed by future research. First, the validation or testing of the societal resilience designs crafted in the collaborative workshops is outside the scope of our proposed research questions. The validation of designs is a more complex and time-consuming task, making it challenging to adopt in a research setting with limited resources [14]. To address this gap, future work should develop frameworks and heuristics for evaluating the ability of translational design cards to enhance societal resilience.

Second, our design practitioner participants were not actively involved in research and design for societal resilience. We acknowledge that the findings presented in this study could be augmented by including societal resilience designers. Future studies should explore participatory research involving societal resilience researchers and designers while developing card-based translational design tools for societal resilience.

Lastly, the design cards' format limits the amount of information that can be conveyed [1, 35]. To address this design constraint, we distributed framework constructs across several cards, enabling researchers to present them in a more detailed and nuanced manner. Such partitioning into discrete units may lead to the loss of complex interconnections among intertwined framework constructs. We used visual and textual clues, such as color coding, preview images, transition text, etc., to create links between the cards (Fig. 5d) and help designers gain a comprehensive understanding of the interconnected constructs. Future research should investigate the suitability of cards as translational design tools through comparative studies, where some practitioners will be provided a card deck and others will apply research insights (e.g., frameworks) without a card deck. In addition, future research should explore opportunities for augmenting design cards by parallel adoption of other design tools, for example, incorporating elements like personas, scenarios, and worksheets alongside design cards [53].

## 9 CONCLUSION

The paper presents a card-based translational design tool to communicate academic research insights with designers to guide designs for social aspects of societal resilience. We conducted a two-stage study with 14 design students and eight professional designers to explore the design and use of the design cards. Our findings reflect on the value of the cards as a translational design tool. The cards allow design practitioners to make sense of research insights embedded in them and apply the knowledge in practice to design utility-focused services or solutions for societal resilience in times

of crisis. We discuss design cards' generative value for informing research insights and explore the cards' extensibility to accommodate new and emerging research insights. Finally, we discuss recommendations to enhance the design and use of cards beyond the context of societal resilience and advance the collective knowledge of future HCI work on translational design tools.

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