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COVID-19 Kindness: Patterns of Neighborly Cooperation during a Global Pandemic

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ABSTRACT

The COVID-19 pandemic outbreak, which began in late 2019, brought unprecedented impact to healthcare, the economy, and social structure, and infrastructures experienced breakdowns in the initial phase. Demands in social and material needs surged, and they could not be met solely by unprepared infrastructures. Although local communities complemented them in previous disasters, physical distancing measures to prevent the spread of the virus under- mined human connection, and local communities had to come up with novel ways to provide support. To develop insights from such adaptations of local communities, we explored civic activities for immediate disaster relief in multiple local communities across the United States and interviewed civic initiative organizers and attendees. In this paper, we articulate our findings into *pattern language*, a schema of reusable solutions for recurring problems. We present two patterns for community-based disaster recovery and discuss the effectiveness of codifying civic activities for disaster relief into patterns.

CCS CONCEPTS

- **Human-centered computing** → **HCI theory, concepts and models.**

KEYWORDS

pattern language, community-based disaster relief, disaster relief, community resilience

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INTRODUCTION

In December 2019, a severe pandemic outbreak known as COVID- 19 shocked the world with its unprecedented scale and duration. So far, the pandemic has lasted over a year, from the initial outbreak in late 2019 to late-April 2021 (the time of this writing); over 3.14 million deaths and around 149 million cases were reported [39]. This virus revealed society's unpreparedness for a pandemic, which profoundly affects on healthcare, economic, and social systems. For instance, the United States underwent infrastructural breakdowns at the beginning of the outbreak: hospitals confronted shortages in medical resources [53]; schools struggled to move classes online with restricted resources [21]; while panic-buying and stock-piling of necessities incurred supply chain disruptions [37]; more people were laid off during the first two months of the outbreak in the United States than in the Great Recession [6].

During previous disasters, citizens have often been identified as *first responders* for disaster relief before officials enacted disaster response actions or until infrastructures recovered [13, 16]. In typical crisis scenarios (e.g., storms, floods, fires), human connection has been a persistent resource and a key to recovery [32, 35, 44]. For instance, local community members gathered in a gym as an assistance shelter to distribute hot meals [26] or shared extra room, bed, or couch to provide shelters for impacted neighbors [27]. However, what differentiates COVID-19 from other disasters is the physical distancing measures put in place to prevent the spread of the virus. People were reluctant to visit public places or to interact with others. Local community efforts for disaster relief could not be made in the same way as in the past. However, this is not to say community-based disaster relief did not exist during COVID- 19; rather, we observed an outpouring of local community support since the outbreak. Citizens adapted to the restrictions and modified disaster relief actions to support impacted others. Gaining an understanding of how local communities initiated relief with reduced physical contact is essential for future pandemic response. In this paper, we focus on the initial phase of the pandemic in the United States (March to July 2020) because this was the time period where substantial social, economic and personal health adjustments had to be made, which strained key infrastructures and supply chains. This led to our first research question: *(1) What adaptations were made by local communities to provide support at the beginning of the pandemic outbreak?*

Another focus of this study was to develop our findings into a reusable resource for future disaster planning. Although it is not a routine disaster, recent research in climate change suggests there will be another pandemic [55]. We aimed to uncover the problem-solving processes that local communities used to address the needs incurred by COVID-19. If our insights are practically codified into structural guidance, local communities that face another pandemic in the future can refer to it and may be able to better and more immediately respond to a crisis. To be used as guidance in the future and in other local communities, we wanted to pass down a generalized yet concrete solution that local communities can realize. *Pattern language* framework developed by Alexander [1] fits our requirements as a standard solution schema framework for recurring problems. The goal of pattern language is to make reusable solutions designed based on prior experience without trial-and-error. This is critical for disaster situations because there is no time to test which solutions are feasible during the chaos of a disaster, but a prompt response is necessary. Pattern language is an organized problem-solution pair that clearly outlines which solution is plausible when a problem occurs, what should be considered to practice the suggested solution, and what outcomes can be expected through its distinct elements. The elements describe a schema abstract and general enough to be applied in different contexts, but one of the elements is a concrete example to help understand its implementation. Thus, we decided to format our learnings into pattern language, which we propose as guidance for local communities in the next pandemic outbreak. This led to our second research question: *(2) How can local community pandemic relief be formulated into patterns to provide guidance in future pandemics?*

We used these two research questions as a guide to compiling a list of local civic disaster relief activities initiated in different regions across the United States, which provided neighborly support or revitalized aspects of communities that were negatively affected by the pandemic through information and communication technologies (ICT). Next, we interviewed 18 civic initiative organizers who gave us insights into their executive strategies, points to be considered for operation, and outcomes, which were elaborated by interviews with three attendees. Based on the interviews, we applied the pattern language framework to our data to develop reusable patterns for disaster relief in the initial phase of a pandemic. Our study makes a major contribution through applying pattern language to the new context of community-based disaster relief, which has not been conceived as its domain. We contribute

literature on disaster recovery patterns with the community-based pandemic relief: the *local expert network* pattern and the *virtual third place* pattern.

RELATED WORK

This section compares community-based disaster relief with the command-and-control model and reviews previous examples of how ICT strengthened community-based disaster relief. We then provide a brief background on pattern language and its usages to codify human activities.

Community-based Disaster Relief

In emergency disaster planning, the “command-and-control” model has taken prominence for the past decade [17]. The model is focused on the development of formal government agencies and top-down authority structures to communicate and operate decisions and actions for disaster management [17]. This top-down approach can efficiently provide and distribute formalized emergency re- sources, such as food, shelters, hospitals, or police to where they are needed in massive amounts. However, they cannot always be prepared for every disaster. Official disaster recovery strategies are appropriate for disasters that can be expected and are likely to happen with some frequency, but they cannot be fully effective against rare or surprising disasters [29]. When the disaster scale or duration is unprecedented, governments and related institutions may struggle to provide sufficient resources or services. They can eventually improve once they understand the threat dynamics (e.g., what is needed to which extent), but infrastructures can undergo a breakdown phase at the very beginning of the outbreak. Prior research has emphasized government collaboration with citizens and local communities in the immediate aftermath of infrastructure breakdowns [7]. However, an inadvertent consequence of the “command-and-control” model is that authorities may less involve citizens in disaster response activities. The potential of civic capabilities to deal with disasters can be under-leveraged, albeit they are already available, strong, and local communities are willing to offer them.

“Community-based” disaster relief incorporates social capital into disaster recovery, taking a bottom-up approach which seeks community input and active involvement [26]. In contrast to the common belief among authorities that panicked citizens behave irrationally when disasters occur, citizens have long been *first- responders* on the scene before official

agencies arrive [13, 16]. Local citizens have provided immediate shelters, hot meals, search and rescues, and help with clean-up [13, 26, 50]. The potentials of community-based disaster relief have shown remarkable growth with the development of ICT. People uploaded posts on Twitter to reach out to families, friends, or even to unknown neighbors to offer shelter or food after the 2013 Boston Marathon Bombing [27]. Local citizens used microblogs and community websites to provide shelter, donations, manual labor, emotional support, and information about damage with videos and photos in the aftermath of the 2005 Hurricane Katrina, the 2004 Indian Ocean Tsunami, and the 2007 Southern California wildfires [31, 41, 47]. After the 2007 Virginia Tech shooting, community members collectively generated a correct listing of victims and missing persons using Facebook before official responders could compile their list [54].

Disaster recovery performance can be enhanced when the capabilities of local communities are mobilized alongside formal government structures [35], but community-based disaster relief is sometimes considered to be at odds with the command-and-control model [26] as they engage through two different approaches; top-down and bottom-up. However, the community capacities to cope with disaster can rather be regarded as “double capacity” in conjunction with formal emergency agencies to better cope with disasters. To make it possible, what is learned from local community initiatives in previous crises should be made reusable in future similar outbreaks. However, research to date in community-based disaster relief is limited to exploratory case studies. Although they demonstrate rich evidence that local communities could provide practical support for disaster recovery, how such initiatives can be actualized and practiced in other communities that face similar crises is not well addressed.

Pattern Language

Pattern language is an organized and coherent set of patterns, each of which describes a recurring problem and possible solutions that can be used in creative ways within a specified field. It provides solutions that are concrete enough to be implemented immediately, but abstract enough to be applicable to situational variations [1]. The term *pattern language* was coined by Christopher Alexander to describe design problems and solutions in architecture in his 1977 book *A pattern language: towns, buildings, construction* [1]. He identified over 250 patterns, which cover a range of scales, from large patterns for distribution of towns to patterns for rooms in a home. In Alexander [1], the patterns are loosely connected across

scales, with a large pattern typically housing smaller-scale supporting patterns [3]. Pattern language traditionally follows a set structure [2], where each pattern contains a *problem*, *context*, *solution*, *forces*, *resulting context*, and *known uses*. We provide details on this ontology below:

1. **Problem** - The specific details of the problematic situation to be addressed by the pattern.
2. **Context** - Background description of a problem.
3. **Solution**: An effective method to adapt to a problematic situation.
4. **Forces**: Elements that can facilitate or constrain possible solutions.
5. **Resulting Context**: Expected outcomes once the solution is executed.
6. **Known Uses**: An example of the pattern observed in the real world.

Although pattern language is applied to provide solution schemata in different sectors, little is known about the procedure of pattern language development. To introduce a few prior examples, Iba et al. [22] invited domain experts to brainstorm patterns with their tacit knowledge through collective discussions. In another study, potential users of a pattern were invited to a one-day design workshop to devise patterns together [28]. Patterns can also be crowd-sourced on a larger scale with a public pattern management system where individuals voluntarily upload and edit patterns online [45].

The construct of pattern language has been proven to be a widely applicable approach to describing practices in fields ranging from internet security [18] and privacy [20], biology [36], to interaction design [3, 8]. Another strand of pattern language research addresses human activities. In Schuler [46], over 130 patterns are introduced to address how civic intelligence can be used to solve social and environmental issues and support a democratic society. Carroll and Farooq [10] proposed patterns to address the problem of organizational knowledge loss and difficulties of information technology maintenance for local nonprofit organizations through the community-based collaborative learning patterns. Pattern language has been applied to disaster research in limited cases and under-explored. Toups et al. [51] proposed a game design pattern for disaster response, which suggests what designers should consider for an effective game-based disaster response simulation. Furukawazono et al. [19] developed pattern language for individual response to an earthquake, ranging from patterns for preparation, patterns during an outbreak, and patterns to address the aftermath. However, to our knowledge, pattern

language has not been developed to address long-lasting and widespread disasters such as COVID-19. COVID-19 gave us a rare opportunity to understand the dynamics of a long-haul pandemic threat and its related problems and workable solutions. Moreover, COVID-19 was a pandemic of unprecedented scale, and governments did not have the experience to handle this type of severe pandemic and went through unavoidable infrastructure breakdowns at the beginning of the crisis. In the initial phase of its outbreak, community-based civic initiatives complemented government response, which can be articulated into pattern language for future pandemic relief.

METHOD

Pattern language can be defined after observing a positive set of solutions practiced in the real world and integrating their common facets [2]. We initially collected real-world examples of COVID-19 relief civic activities. After the thematic grouping process on collected examples, we conducted interviews with organizers or attendees of some civic activities that respectively covered different themes. Based on insights from interviews, we inductively identified attributes that were common across different civic activities, which can be developed into pattern language.

Collecting Community Initiatives

From March 20th to July 17th, 2020, 10 study investigators collected examples of civic activities for disaster relief during the COVID-19 outbreak across the United States. Because we did not know at first how different they were from civic activities in prior disasters, we collected as many activities as possible from email listservs, online local/national press, and social media. We documented them on a shared spreadsheet and met weekly to share new items we encountered.

After documenting civic activities for four months, we started to thematically group them based on their contributions to the community. We first borrowed Cutter et al. [15] indices of community resilience during disasters, including Infrastructural Resilience, Economic Resilience, and Community Capital for reference as we developed our preliminary conceptual themes to house our civic activities. We further developed specified sub-themes which emerged from our collected data, such as educational resources, physical/mental well-being, collective gathering, food donation, or local business support. We focused our

efforts on collecting additional civic activity examples for the sub-themes with fewer examples. We ended up with a collection of 158 civic activities as of July 17, 2020.

Interview Study Design and Participant Recruitment

We had iterative weekly meetings to discuss how newly added civic activity examples were novel and interesting during the data collection process addressed in Section 3.1. We noticed that some of them were remarkably distinct from other civic disaster relief activities observed in previous disaster scenarios. To understand how they were implemented and how they turned out, we decided to interview their organizers. We selected such novel initiatives across different themes intending to address diverse community resilience domains. We found contact information of organizers from their websites or email listservs and sent out 42 interview invitations through email, of which 16 organizers responded affirmatively. We used snowball sampling to interview the three attendee participants, when their contact information was presented to us by activity organizers.

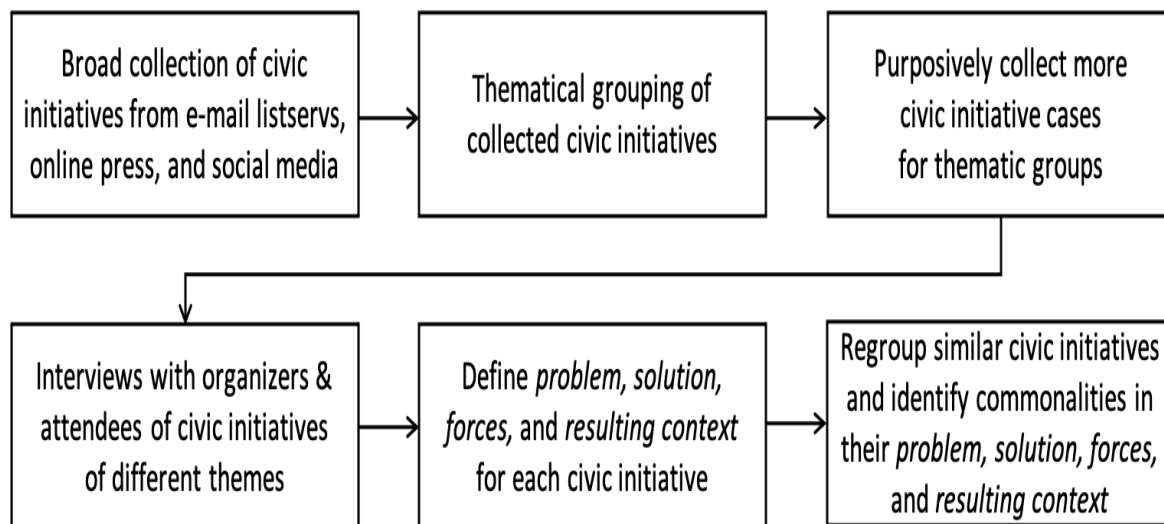


Figure 1: Flow of Pattern Language Development

We conducted a total of 16 interviews: 13 sessions were with 18 organizers and 3 sessions were with 3 attendees. Table 3 in Appendix shows the role of each interviewee and a brief description of the civic initiatives they engaged in. Most interviews were conducted one-on-one, aside from four interviews where the participant was joined by his/her colleague(s). Each interview lasted between 40 and 60 minutes and was conducted virtually either a Zoom video or voice call.

Our goal was to gain a rich understanding of how organizers adapted civic initiatives to the restrictions around slowing the spread of the virus and how attendees experienced these initiatives in their local community. The interviews were semi-structured and included some predefined questions, questions to elicit people's stories, and spontaneous add-on questions based on responses. For organizers, predefined questions included: (1) which COVID-19-related societal problems they tried to solve; (2) how they implemented their initiative; (3) any challenges they encountered; (4) their accomplishments; and (5) what they saw as their impact on the local community. Predefined questions for attendees were: (1) what motivated or discouraged participation; (2) their experience of the activity; and (3) and how they felt towards the initiative. The work described here was approved by the university Institutional Review Board (IRB). The process of informed consent centered on voluntary participation with no compensation. We explained the study and obtained verbal consent from each interview participant prior to asking any questions for research purposes.

Data Analysis and Pattern Development

All interviews were fully transcribed, and we first identified facets that were common across different civic initiatives, which could later be generalized into pattern language. Three study investigators read through the interview transcripts and highlighted remarkable aspects, such as novel operational strategies or unexpected results. We then had two rounds of defining the pattern language elements. In the first round, nine study investigators discussed highlighted interview quotes with a focus on defining the *problem*, *solution*, *forces*, and *resulting context* for each civic initiative. Civic initiatives that made contributions to their local community in a similar way were then grouped together. In the second round, we identified common aspects of pattern language elements across civic initiatives in the same group, which we then classified as a pattern. We assigned each identified pattern a name that could represent all the civic initiatives nested under that pattern, analogous to Alexander [2]. Although our analysis

surfaced many themes, we chose to present only those themes relevant to answering our research questions. The two patterns articulated in Section 4 address RQ1.

PATTERNS OF COMMUNITY-BASED DISASTER RELIEF

Due to restricted physical contact and the unprecedented scale of the pandemic, citizens were unable to exchange local support as they had in previous disasters. In this section, we introduce two patterns. The first pattern is the Local Expert Network Pattern, which elaborates how communities mobilized social capital and supplemented necessary resources which the government did not sufficiently provide. The second is the Virtual Third Place pattern, which outlines how communities maintained human connections through third places preserved in virtual settings. We followed traditional pattern language structure proposed in Alexander [2] and each pattern is composed of *problem*, *solution*, *forces*, *resulting context* and *known uses*.

Local Expert Network Pattern

The sudden outbreak of the pandemic caused unexpected problems in the economy, healthcare, and social structure. Multiple layers of different problems made it difficult for official disaster responders to sufficiently and immediately provide resources and services to those in need. This pattern outlines effective means to leverage citizen resources and skills to resolve social issues.

Problem. This global, long-lasting nature of the pandemic makes it an unusual disaster scenario compared to other common crises (e.g., floods, hurricanes, earthquakes). Other than the spread of the virus, COVID-19 damaged social functioning and unanticipated issues which this generation did not experience. At the beginning of the pandemic outbreak, infrastructures broke down, and governments struggled to produce and distribute critical products, resources, and services.

The most immediate issue that arose in the initial stage of the crisis was a worldwide shortage of medical supplies. With an overwhelming flow of patients from the pandemic, hospitals lacked intensive care units [53], medical workforce [56], and personal protective equipment (PPE) [43]. For instance, PPE, such as masks, was indispensable to prevent virus transmission. Not only they were needed at hospitals but WHO also highly recommended that all citizens begin wearing masks in everyday life [40]. PPE ran into supply chain

shortages from the pandemic, and governments in different countries initiated purchase limits and imposed export bans on them. Other than medical supply shortages, governments also encountered unexpected supply chain issues of food and household consumables. In the initial stage of the pandemic, panicked people stockpiled food and household goods like canned food, milk, or toilet paper, which resulted in retail purchase limits [37]. Even after supply chain systems stabilized, people with pre-existing health problems and others who were vulnerable did not feel safe to go out to places with large crowds, like grocery stores or public transportation.

Table 1: Schema of Local Expert Network Pattern

Pattern Language Element	Descriptions
Problem	Incidental societal problems from the pandemic and insufficient official disaster response
Solution	Social capital mobilized at the hyperlocal level with local experts connected through “hub”
Forces	<i>Force 1: Enthusiasm in participation can wane and difficulties of recruitment</i> ⇒ Steadily inform how influential personal and group contributions were
	<i>Force 2: Reduced face-to-face interaction and unplanned interactions</i> ⇒ Promote an initiative through digital communication systems
Resulting Context	<ul style="list-style-type: none"> • Sufficient provision of resources and services in need
	<ul style="list-style-type: none"> • Emulation in other communities
	<ul style="list-style-type: none"> • Increased self-satisfaction and self-efficacy among volunteers
	<ul style="list-style-type: none"> • Collective skills added to the community to better cope with future disasters

The pandemic not only incurred new unexpected issues but it worsened and surfaced existing societal issues. During the first two months of the pandemic outbreak in the United

States, 20 million people filed for unemployment, which was more than the number of jobs lost during the Great Recession [12]. Layoffs and bankruptcies deepened economic inequality and increased public demands for government subsidies. Many people were newly unable to afford rent, basic necessities, or food. Those who used to rely on nonprofit groups or public schools for food assistance before the pandemic were in more dire situations due to backlogs and school closures. Some could not afford internet service or digital devices, which was often necessary for work, classes, or consultations with doctors. Those without internet connectivity or computers were restricted from social services and activities that had moved online.

Solution. Social capital refers to the potential resources of support in their forms in goods, labors, or skills, embedded in social networks like families or friends, workplaces, or neighborhoods. Social capital in local communities can be made visible through civic activities. During the pandemic era, people with specific skills and/or resources positioned themselves in roles for disaster relief, which we found mobilized social capital. We call this *local expert network*. They supplemented government resources and services, and this was possible due to the cooperation of citizens with diverse capacities who connected through a “hub” or “super-connected” network [29], which was available through different usages of ICT like dissemination of email listservs or websites.

P6 and her friends published an online website where citizens could purchase a meal from local restaurants for healthcare workers or people experiencing food insecurity. Citizens showed support for others in their community while also helping to revitalize the local service economy; local restaurants cooked and delivered hot meals for healthcare workers and food-insecure households; healthcare workers fought against the virus on the frontline. Other local businesses and individuals held virtual fundraising events to further support this initiative:

“There was a gallery that reached out to us back in March...[they] wanted to be doing...online exhibitions where they could support their artists but also donating to [our] cause...Fitness professionals, they would reach out to us and say, ‘Hey, can we do this fund raiser?’...it was a combination of people using whatever skills they had and whatever product they could offer to entice people to donate to a cause...[One comedian]...wanted to use his skills as a comedian and his network, he wanted to put on a fundraiser to raise money for [our cause]” (P6, organizer)

In another case, P5 and her colleagues built an online platform to match local people

who offered to provide support with those who needed it in a way that physical contact was not involved. If people submitted a request such as a grocery shopping or curbside pick-up, the platform connected the person with a volunteer nearby who could make the delivery. Apart from individual volunteers, P5 described how partnerships with other businesses or non-profit groups helped them diversify what they could offer.

“If you see [our initiative] in the middle as a technology platform...we have a bunch of different bubbles on this side with donors...donating food. And we have logistics partners...that are actually doing the delivery, and so Uber would fit into that bubble, [who] agreed to provide us a certain number of free rides...So when Optum wants to deliver these donated goods that they have, they can use Uber through us. And then we have a volunteer network which can come from variety of different [organizations]” (P5, organizer)

Similarly, P4 and her public transit group colleagues appropriated portions of their fleet for delivery service for people who were sheltering in place due to their high risk for COVID-19 complications. People in need of delivery could call the transit group to provide their grocery list and make payment online, and the transit group would organize volunteer shoppers from a local church, who would complete the list and bring the items to the transit group for delivery. The transit group also partnered with the Commission on Aging and local restaurants to deliver free meals to older adults who lived independently or students who would normally receive subsidized meals from their schools closed during the crisis.

P7, P8, and P9 were members of a civic group whose mission was to narrow the digital divide that was deepened during the pandemic, as regulations aimed at reducing the spread of the virus forced schools, libraries, and other public access points to move online. They collected no-longer-used laptops, formatted them with Linux, and distributed them to local people who needed computers, which became indispensable necessities during the pandemic. This civic initiative was possible owing to people with complementary skills and resources: local people donated old laptops or other computer accessories they no longer use; retired programmers in town and members with back-end technical skills wiped data from hardware and installed a new operating system; a member with front-end skills built a website for this group which included donation forms and tutorials for how to use the laptops and software; other members made phone calls and did Zoom tutorials for those who received laptops.

The group also had partnerships with a non-profit organization to identify people who were in need of a computer. Layers of skills and resources enabled each step towards getting the laptops to their recipients and helping recipients make use of them.

Besides instrumental support, emotional support was contributed by local citizens. For example, P2 organized a student group that provided emotional support for isolated seniors in local nursing homes, leveraging various skill-sets. Due to the pandemic, all visits, deliveries, and letters were not allowed in nursing homes, so the group decided to send an entertaining video which was *“like a greeting card and a talent show”* (P2, organizer). Group members called for volunteers and collected videos or photos from other students, where each one of them played an instrument, sang, or danced at their house. P2 combined and edited the video clips and photos, which she later sent to local nursing homes.

These civic initiatives were feasible as they utilized existing capacities in their communities, rather than asking people to contribute in completely new and unfamiliar ways. P3 decided to participate in the initiative to make fun videos for nursing homes because *“the point was using the skills [people] already have to make something impressive...[and] they were asking for things that [he] had skills to help with”*. Sometimes, available expertise in the community was leveraged through creative adaptations to make them more relevant to disaster relief. In another example, people were committed to supporting their fellow citizens and spontaneously adjusted their skills to produce PPE:

“We had local distilleries that quickly stepped up and switched their processing over and started distilling hand sanitizer...A small family business that makes custom snow skis quickly switched over and started making plastic face shields.” (P4, organizer)

The *local expert network* pattern is available through connecting people with complementary resources or skills. These civic initiatives were *“community efforts [from people who] came together to help each other out”* (P4, organizer) at the *“the hyper-local level”* (P5, organizer).

Forces. The key forces to realize this pattern is motivating existing volunteers and keeping them engaged long-term. However, enthusiasm in participation can wane, particularly when individuals work collectively [23] in a long-haul crisis, such as the COVID-19 pandemic. P5, an organizer, told us that *“Continuing to activate volunteers and getting people excited. is*

a continuing challenge for the organization". Prior work suggests that groups can prevent high turnover and keep members motivated if they steadily provide consistent information on group performance [23] and how the initiative contributes to the cause. We noticed a similar phenomenon in the initiative that P6 led, which received monetary donations to buy meals from local restaurants for healthcare workers and others in need. Their website was frequently updated with the number of healthcare facilities and shelters that received free meals and the number of restaurant employees rehired to support the demand, which made the group's social impact public. Similarly, the civic group for computer donations led by P7, P8, and P9 had a banner on their website which updated the number of computers that had been distributed. Publicizing successful group performance can also be effective in attracting more newcomers because people tend to be more interested in productive groups [23].

Motivating group members can be challenging when face-to-face contact is reduced [34, 52], because the frequency of unplanned interactions which occur from physical proximity is critical in team collaboration [25]. Recruitment of newcomers also becomes more difficult, as reduced interactions result in fewer chances to promote the group. This was an inevitable situation during the pandemic when face-to-face contact had to be minimized. P2, an organizer, mentioned that this caused difficulties for recruiting help: *"[Before COVID-19,] you can always grab someone in the hallway and push them a little to get that going for us...[During COVID-19]. you cannot accost anyone to try and get. what you need"*. Civic organizers rarely got a chance to talk about their initiatives or recruit volunteers in face-to-face settings. Instead, they promoted their groups through digital communication systems, such as *"different networks using GroupMe and listservs"* (P2, organizer) or *"posting some photos on social media,..., sharing the website link. [tags] on the Instagram"* (P6, organizer). P7 mentioned how spreading the word about their initiatives via online news raised donations:

"It was just articles by P8, about what we are doing on the online website and then the editor of our local newspaper saw that. and asked P8, 'Can we run this same article in the newspaper?' That generated a lot, a whole lot of donations, and is continuing to do so." (P7, organizer)

Aside from recruiting participants, P4 emphasized the role of digital media to increase awareness of the group to people who are in need, so that more people can benefit from them: *"The [local] print media. and television stations covered some of [what we] have*

been doing, and that's been real helpful to push that information out...so people can take advantage of the services we are providing.” (P4, organizer).

Strategies to reduce social loafing should be operated to retain successful local expert networks, which involve giving members feedback about individual and group performance. Organizers can overcome the decrease in face-to-face interaction and raise public awareness about their initiative by facilitating engagement through social media, email, instant messaging apps, or websites. Organizers should try to reach out to both ends; to people who can provide support and to people who need support.

Resulting Context. One of the likely consequences of the *local expert network* pattern is that it eases disaster management by addressing the crisis of a surge in demands for basic necessities and service, which formal institutions cannot sufficiently meet. For instance, P6, an organizer, said her initiative raised “\$24,000 just in *[their]* first 24-hour period...and delivered over 127,000 meals to healthcare workers and...*[those]* experiencing food insecurity”. The computer donation initiative led by P7, P8, and P9 distributed 105 computers to those in need as of February 8, 2021. Similarly, P4 told us that vulnerable individuals in her region benefited from the initiative she led because “*[they need not]* worry about getting groceries,...prescriptions, ..., or having their *[free meal programs]*...not being available, because we were able to step up and be able to provide that service for them”. These examples demonstrate how social capital can be actualized to supplement government and formal institution efforts.

A further impact of the *local expert network* pattern is that successful initiatives can spread through emulation to other communities. The initiative P5 led in her community stretched out to “*Los Angeles, Bay area, ..., some places in North East, as well as...in Chicago*”. P6 explained how people in other regions spontaneously reached out to her group organizers to learn how to start a similar initiative in their town: “*We got calls from people in Orange County, California, Miami, Boulder Colorado...[One of them] started her own version of Feed the Frontlines in Marin County, California.*”

We asked other organizers, such as P7, P8, and P9, if they received inquiries from others who wanted to build a group like theirs. They also had people reach out from neighboring counties and decided to write up instructions so that other people could replicate their initiative.

“We are working on the instruction part of it now, [on the website], so that anyone that would want to duplicate this effort would have an image installations, basically a read-me manual...that would document step by step how you install the program, how you set it up. And we are trying to set it up as simple as possible.” (P9, organizer)

A broader effect of this pattern is its’ positive impact on well- being. Many people who had to stay home due to the virus felt *“anxious and helpless”* (P6, organizer). Joining a local expert net- work initiative can help people recognize that their expertise and resources are valuable contributions for disaster recovery: *“People...are able to put some hours into feeling like they are making an impact, and a lot of us were feeling less helpless.”* (P5, organizer); *“It* self-efficacy, a belief that they can make contributions to local communities during the pandemic. The effects of improved well-being are particularly important during long-term psychologically distressing events [4, 33, 42].

Experiences of operating and participating in local expert net- works are a collective resource added to the community. One of the civic initiative organizers was already working on a new project to prepare for the next wave of COVID-19 or future pandemics, to be *“proactive and ready”* (P4, organizer). Gaining experience with the first initiative improved P4’s level of preparedness, and she was confident that her group *“can do better in the next round if the need arises and...implement other services to be able to help additional people.”* Another organizer, P5, was already preparing *“[planning] to continue [her] nonprofit effort beyond COVID-19...[as] there always, unfortunately, will be people in need, there is always people who want to help”*.

Known Uses.

In this subsection, we detail an exemplary organization to illustrate the full scope of this pattern. MASC¹ is a local-based collaborative PPE manufacturing group initiated in mid-March 2020 by P1, an organizer affiliated with Pennsylvania State University. Their aim was to increase PPE supplies and other healthcare items through manufacturing gowns, air-purifying respirators, masks, diagnostic swabs, disinfectant wipes, hand sanitizer, and ventilators. The organization served hospitals and long-term care facilities, who could request items through their website.

¹ <https://masc.psu.edu/>

The group grew into a “super-connected hub” where an interdisciplinary team of 350 researchers, local businesses, and non-profit organizations came together to address the problem of PPE shortages. Members utilized and adapted their expertise in different directions toward this cause. For instance, faculties in the Department of Mechanical Engineering and local maker-spaces provided manufacturing space, 3D printers, and expertise in 3D printing to fabricate plastic face shields. Costume designers from the School of Theater, the school athletics uniform makers, and local independent theaters collaborated to create a digital pattern for gowns and to sew gowns and masks. MASC leveraged faculties from the College of Business to manage supply chain systems and design efficient distribution channels to local hospitals and nursing homes. People took a role based on their strengths or experience, which was critical for the longevity of the collective effort.

MASC motivated existing members to continue their work through their daily listserv messages where they shared an update on the ongoing process and highlights from the day, including impacts of their contributions. Non-members could subscribe to the listserv through their website, which introduced them to the initiative, and provided examples of how various types of expertise could be used. P1 explained how the e-mail listserv facilitated recruiting more people to the organization: *“They could start reading the updates and then people would start responding and say, ‘Hey, I can help with this or I can help with this.’”* The group recognized the salience of easy access to and wider distribution of information about the group to attract newcomers. P1 told us how he and other members used their e-mail signatures for recruiting: *“I changed my signature so was nice to...see that I can do something to help”* (P3, participant). Engaging in practical support can increase self-satisfaction and *that people could see what was our website, how they could contribute, and how they could make a donation.”*

MASC was successful in providing sufficient amounts of PPE and other healthcare items to 221 local nursing homes and hospitals as *“they never ran out of any critical supplies”* (P1, organizer). Besides its success in providing tangible support to frontline workers, MASC also functioned as a channel where local community assets could be plugged in and leveraged for disaster relief. It could be difficult for people without formal medical knowledge during the pandemic to see how their expertise or resources could contribute to disaster management. People *“wanted to help but they weren’t sure how”* (P1, organizer). P1 told us that the group

“gave them a way to share their expertise, and indirectly improve the health, welfare, and safety of our colleagues...on the front lines”, which altered how people thought about their own scope of contribution and responsibility toward the local community.

This case is exemplary of the local expert network pattern. The group empowered ordinary people to engage in disaster relief by utilizing or adapting their skills towards PPE production.

Virtual Third Place Pattern

In the second pattern, we introduce the virtual third place, which is based loosely on Oldenburg [38]’s coinage of *the third place*. During the pandemic, people were reluctant to meet others and were also subject to policies that prohibited large gatherings. This had the incidental effect of undermining core practices of the local community. For the most part, people were restricted from visiting third places, which Oldenburg defined as social places where neighbors could meet and interact casually, strengthening social bonds and community trust (e.g., coffee shops, gyms, bars) [38]. Our data suggest that many of the original third places were rebuilt in virtual spaces. In the following subsections, we discuss considerations for building virtual third places and their outcomes on the local community.

Problem. During COVID-19, multiple phases of restrictions were imposed on social gatherings and local businesses to prevent the spread of the virus. Beginning in March 2020, the US government imposed four levels of interventions: shelter-in-place orders; public school closures; restrictions on large social gatherings; and closures of non-essential businesses, including bars, gyms, hair salons, and movie theaters [14]. The local severity of the pandemic determined the level of restriction, and most communities under-went each stage. For example, local restaurants were required to adhere to occupancy policies such as limiting indoor dining to 25- 50% capacity, allowing outdoor dining only, or no on-site dining (take-out and delivery only).

When the most extreme business closure policies were implemented, third places were completely frozen. Physical spaces were still there, however, people were not permitted to visit. Although restrictions eventually loosened and some third place businesses reopened, many people no longer felt safe indoors. They tended to avoid large crowds, which were known to increase the potential for exposure to the virus. Third places were no longer places where people could casually visit and enjoy pleasant conversations with others without worry. According

to our interview participants, people “[felt] isolated” (P12, organizer) and “[missed] the space where [they were] able to connect with others” (P10, organizer). This isolation and loneliness from decreased interaction with others put depression as a critical public health concern into the spotlight [24]. Closures and restrictions of third places hindered their proper functioning within communities. The sense of community membership derived from third places such as book clubs in libraries, chatting in cafés or bars with a group of friends, or gatherings with church groups for service was lost. Suspended third places surfaced their key role in community identity formation, which had been taken for granted [9]. Gatherings in third places provide a sense of connectivity and belonging; they are a core part of the human experience [11]. Lamenting the closures, P17, a local public librarian questioned: *“how does a library maintain its value and its community if it can’t be the living room that everybody has always used it as?”*

Solution. Since COVID-19 restrictions have shuttered or limited most physical third places, we found that neighbors can gather in virtual third places to interact and develop a sense of belonging owing to ubiquitous ICTs. Many third places, including a local community space, fitness centers, public libraries, museums, and local festivals have set up their events and spaces online. Our study demonstrates that virtual spaces can complement physical third places that are frozen in the initial phase of the pandemic.

P10 and P11 organized a local community space that had to be closed down since the COVID-19 outbreak. Before the outbreak, it used to be a space where community members could gather to interact or enjoy performances by local artists. After the pandemic, they moved all of their events online *“to continue to provide the experience virtually”* (P11, organizer); they organized Virtual Potluck Brainstorm events where *“people were invited to bring their dinner to eat ...[and] participate in a virtual brainstorming event to create ideas for creativity in [the local community]”* (P11, organizer); and public conversation events which *“is just an open forum for anyone in [local community] to come and bounce ideas off of others”* (P10, organizer) and talk about certain topics such as *“race inequality in [local area], social justice issues”* (P11, organizer). This organization showed that interactions with locals could be continued even though people are not in the same physical space.

P12 and P13 were coaches at online group workout classes. They moved their classes to a virtual setting in April 2020 and people who wanted to join their workout classes were

provided with a link to group video calls. Besides doing workouts, P12 explained how enthusiastic people were to engage with others in her workout class: *“When we’re on Zoom, they all want their cameras on...they may come closer to the screen...[to see] other people.”* P13 emphasized that the time before and after the workout session was valued for interacting with others by people who were sheltering in place:

“I call it the Brady Bunch screen and before and after class...people come in, and they talk and especially the seniors. I realized that they needed to talk to each other and that is important as they are not able to go out and talk to each other anymore.” (P13, organizer)

P17 and P18 were staff members in a local public library that held multiple virtual Zoom gatherings, such as book clubs, knitting clubs, board game hours and weekly story reading sessions for kids, and a Book Fest where people could interact with famous authors. P17 explained how their virtual gatherings supported community interaction: *“it’s giving opportunity for people to get connected with each other...people are happy to engage with each other, they are happy to share their ideas...It’s a close approximation of what it would like to be together.”* Similarly, P18 described how their Weekly Story Times, where librarians read stories to kids, supported his son’s well-being during the child’s often lonely virtual learning experience.

“Weekly Story Times...really helped [my 3 years old] a lot...[he] is having the hardest time with not seeing other people...the fact that he gets to...build this relationship with staff that are doing the story times, even with other kids. It was really important for him from a psychological perspective. I think that’s probably true for all ages.” (P18, organizer)

Table 2: Schema of Virtual Third Place Pattern

Pattern Language Element	Description
Problem	Frozen third places increased isolation and weakened community identity
Solution	Rebuild third places and continue events on virtual settings
Forces	<i>Force 1: Digital illiteracy or not having digital equipment/internet can limit participation</i> ⇒ Provide technical guidelines or adopt easy-to-use platforms ⇒ Public third places can provide internet connectivity or digital devices
	<i>Force 2: Strategies to attract local newcomers and keep people engaged</i> ⇒ Add explicit forms of localization or replicate a physical space
Resulting Context	<ul style="list-style-type: none"> Extended user base (e.g. blurred geographical boundaries)
	<ul style="list-style-type: none"> Egalitarian space

When a university art museum organizer was forced to re-think how she could provide an engaging environment online, they came up with new ways of replicating a physical third place. They developed online exhibitions with virtual tours, virtual gallery style exhibitions, and art making activities which were all performed virtually on Zoom or YouTube Live. For instance, in the virtual tours, docents recorded themselves as they walked through the museum and explained each art piece; in the Sketchbook Series exhibition, museum staff introduced a style of artwork or an artist and opened up a discussion for people to share their thoughts with others. P19, a museum staff, described how these activities helped people feel connected to others in their local area: *“It really helps people to stay connected as a community...[Docents] have been very grateful. They’re like, ‘Oh, [a virtual museum tour] is good. It really was helpful to keep me feeling like I have friends and people to work with things on.’”* P20, another staff in the museum, saw more active interactions between museum attendees when they were placed in online settings than in a physical environment: *“Not only were people wanting to engage [online] but they actually were engaging more than they previously had when they could come to the museum.”* Ephemeral events, such as local festivals, provide a backdrop for people to relax, socialize, and strengthen their community connection, turning them into a short-term third place. During the pandemic, local festival organizers had to quickly adapt their offerings to a virtual experience. In this example, a local arts festival organizer mimicked the third place environment of the festival through an online gallery exhibition, virtual community classes such as yoga and belly dance, an artists market where people could talk to local artists. P21 told us how important holding the local festival was for his local community at least virtually during the pandemic:

“[The festival] was just a little bit of normality...there’s something out there that you can hold onto...For so long in America, we haven’t been able to go to...any in-person event, but we can at least go virtually for the Arts Festival...People would send us...a letter of how therapeutic this was during COVID and it gave them something to do, something to look forward to.” (P21, organizer)

As in other third place examples, community members engaged with others in this festival as if they were physically together, enjoying the same moment:

“There was a lot of chat that was going back and forth when people would see their friends come in to the show. And they would reach out and reference

something that had happened in real-time like, ‘Oh do you remember when we used to go to the bars to hear this band? I love this song, will you please play this?’...It was a hallmark of a real event...” (P21, organizer)

Responses from interview participants demonstrated that although visiting third places online was not part of their pre-COVID routine, people started to bond with their neighbors in the virtual environment. Serendipitous interaction and discourse are characteristic of physical third places [38], and we noticed such interactions and conversations also occurred in the virtual third place. In this way, digitally mediated communication using ICT can build social presence, which is a critical factor in community interactions and a sense of bonding [5].

Forces. The key condition for third places is welcoming public spaces that anyone in the community can easily access. Making a virtual third place accessible to everyone can be a more challenging experience than a physical third place because joining a virtual third place requires basic technical skills and equipment. Some virtual third place organizers noted that one of the difficulties was helping less technologically savvy people participate in virtual third places. Organizers described how virtual settings could be complex for some people to participate and for organizers to arrange.

“It adds a certain amount of stress to [people] that are normally anxious [and] fearful of technology,..., because [they] don’t know how to engage in this environment and how to feel comfortable” (P17, organizer)

“[Organizers] put in a lot of time in learning how to use [the website tool] and then had to get people to learn how to use it as well” (P10, organizer)

Aside from anxiety around using new technology and digital literacy issues, some people *“in more rural communities can have slower [Internet] speeds and can have some problems connecting”* (P13, organizer). Although Internet connectivity and digital devices are increasingly ubiquitous, they are not regarded as “public good” and not everyone is equally represented in online settings [48]. Those without technical skills, digital devices, or Internet connectivity can be restricted from joining or fully engaging in virtual third places. Virtual third place organizers can attempt to make third places more comfortable by providing help and adjusting their online activities for a less technically savvy audience. Some of our participants described how they distributed detailed technical guidelines or intentionally adopted more easy-to-use platforms:

“We developed some documentation on a sort of planning virtual events...to help our communities to adapt to this new normal.” (P18, organizer).

“I have been primarily using Zoom and it is pretty simple to use and I have some people who are not tech-savvy at all and they’re...having no problems.” (P13, organizer)

Third places run by public institutions can go further and provide Internet connectivity or lend digital devices to attendees. The public library *“[extended] WiFi signal exterior to the building even more...and set up a public WiFi presence available and free downtown”* (P18, organizer). Citizens visited the library parking lot to use its public WiFi in cars, and the library also let them borrow laptops.

Because a virtual third place is an emerging space and people can be less accustomed to its environment than physical third places, it can be carefully designed to have visitors feel familiarity and comfort. Organizers can add localization or replicate the look of their physical space [48]. P12, a group workout coach, emphasized familiarity as an attractive feature of a virtual third place, *“People are looking for...familiarity...to see their favorite instructor or just to see the [community] logo on their shirt...was comforting to people”*. Likewise, texts or images shown in virtual third places can be elaborated to include location and cultural context that attendees are emotionally attached to. P10 and P11 described the software they used to create a virtual third place that mimicked their traditional local community space:

“[This software] makes sure that the user experience is what they would get coming into a very unique and vibrant space such as [our community space]” (P10, organizer)

“We use this program and map out what [the building] really looked like” (P11, organizer)

The university museum staff, P19, described how they used *“a 360-degree video”* for virtual reality, as they *“wanted [virtual tours] to be more experiential and to more closely mimic a tour experience at the museum”*. Advanced digital technology enables virtual third places to simulate physical settings and generate the experience of presence in a familiar environment [49].

Resulting Context. Virtual platforms can expand attendee use of third places by providing a virtual mode of access. Although social distancing policies undermined in-person

connections, people actively visited virtual third places. Many third place organizers saw an increase in newcomers who typically did not attend their physical location before COVID-19.

“Now we are reaching a segment of the population that we’ve never reached before...there is 30% of attendees who are completely different population.” (P14, organizer)

“I think [virtual initiatives] allow people to try new things...I have heard a lot of comments like, ‘I would’ve never tried this, but I did.’” (P12, organizer)

The virtual environment opened up the local virtual third places to a broader portion of the population. P18, a public librarian, told us that a former resident joined an event while living abroad: *“Geo- graphical boundaries don’t really apply...we had someone attending our storytimes weekly from Denmark, but they used to live in this area.”* This case suggests that the online environment provides value to the community in that former residents can revisit meaningful local third places and continue relationships with their former neighbors. Virtual third place can extend and prolong community identity across time and space.

In terms of function, virtual third places can go beyond mere replication of their physical counterparts. Third places should eliminate social barriers, such as socioeconomic status [38]. However, physical third places cannot completely eradicate socioeconomic, ethnicity, or gender differences. For instance, P12 shared that social stratification was apparent in her pre-COVID in-person workout classes.

“I’m not proud of this, but when you are coming to a [workout] class, there is a social sorting that goes on...There is [a girl] in the front row and she is got her lulu’s on and the power sneakers,...there is an international student...maybe back in the side, there are two male students...staying in the back row.” (P12, organizer)

Although physical third places do better to flatten such hierarchies than workplaces, deeply rooted notions of race, class, and gender do not entirely disappear [48]. On the contrary, P12, a workout coach described how virtual third places could provide a more accepting environment, *“[Zoom] is a nice filter where you create a group environment, but it’s pretty accepting...a little bit more inclusive...everybody’s in the front row and on the equal.”* It is consistent with the finding from prior research that suggests computer-

mediated intercultural communication can be more egalitarian because the status difference is unnoticeable than face-to-face communication [30].

Known Uses.

*Viral Imaginations*² is an exemplary space for the virtual third place pattern, which satisfied the key feature of third places, a public space that was open to anyone. P14 founded it as an online gallery and archive where the general public can submit and share their writings and artworks during the pandemic crisis. The website was deployed soon after the COVID-19 outbreak. It functioned as an emotional outlet for people and space to engage with others through artworks or writings. P14 described how people bonded through the online platform: *“People are engaging with the art,...with the artists, or artists’ statements about the art, and they are revisiting the site again and again...They are finding a sort of a touchstone.”* Similarly, P16, one of the online gallery attendees who uploaded his painting, explained how he connected with other local people to cope with hardship together:

“[COVID-19] was really more of a collective issue, and I tried to show that in the painting...yeah everyone has those stories, and yeah everyone should be valued, but no one is more affected than others, because we all share tragedies together.” (P16, participant)

Because the severity of COVID-19 affected each location differently, the organization found that people’s experiences and emotions differed by the real-world situation in their neighborhood. The website had a notable feature with which users could search art pieces and writings with zip codes of where a creator lived. Location filtering enabled people to virtually connect with neighbors who are undergoing a similar situation and reinforced empathy and bonding.

Viral Imaginations welcomed every submission without judgment compared to other art submission platforms that selectively screened pieces for inclusion on the forum. Anyone who wanted to share their writing or drawing could submit their work, and unless their contents were harmful to others, they would be exhibited in the online gallery. P15, another attendee mentioned that *“There is no judging other people’s work,..., it validates everyone’s experiences equally...Because art [can be] very judgmental, I like that Viral Imaginations [is] open to everyone’s work.”*

² <https://viralimagination.psu.edu/>

Viral Imaginations aimed to include a diverse population to become more open space. P14 emphasized the importance of being accessible to reach out to less-visible members of the community.

“Often folks with disabilities tend to have higher levels of isolation...We wanted everyone to be able to interact with the website [and] benefit from these galleries and these expressions...so it was important for us to have it be as accessible as possible.” (P14, organizer)

P14 enabled this vision by creating a website that complies with the Americans with Disabilities Act (ADA) compliant. A toolbar allows visitors to toggle between positive and negative contrast, grayscale, and readable font appears on every page. It enables people with color vision deficiency or low vision to view the online gallery.

P14 wanted the online gallery to be a leveler, so she did not ask for personal identifiers such as ethnicity or gender because she wanted to promote social bonding based on the messages inherent in the artwork or writing. People could only see a name of an author or painter, which can also be anonymous, and the county they lived in. P14 said: *“People are connecting and sharing emotions with someone they don’t even know...it doesn’t matter who we are, where we’re from, any of the things that typically demographically divide us.”* Participants genuinely empathized with others through writings or artworks without knowing their identities or origins. This case exemplifies the virtual third place pattern because of its emphasis on communication, accessibility, and leveling.

DISCUSSION

In this study, we presented insights into local community efforts around coping with the pandemic and arrived at two patterns of community support. This section discusses further application contexts of the patterns and the benefits for communities of framing local community-based disaster relief into pattern language.

Application of the Suggested Patterns

Communities can refer to and employ the two example solution schemata introduced in this paper to develop similar collective strategies to better respond at the beginning of a crisis when a similar long-haul pandemic occurs in the future. The two patterns

provide guidance for effectively coping with immediate problems during the early stage of a pandemic outbreak: surging social needs and the fragmentation of community.

For the *local expert network* pattern, we introduced multiple civic initiatives that contributed resources and services which local governments were ill-equipped to effectively provide; ranging from citizen-led PPE manufacturing efforts, emotional relief initiatives for isolated seniors, grocery delivery service, laptop donations, meals for the vulnerable and healthcare workers and financial support for local restaurants. Engaging in disaster relief efforts empowers citizens to take ownership of the health and well-being of their community. In addition, by participating in an initiative, people realize that they are not helpless and can make valuable increases by providing real-world relief using their skills and resources. This pattern adds to evidence that local communities have the capacity to support their government and other non-governmental organizations in disaster recovery efforts. The local expert network pattern could be extended to support other types of needs during the pandemic era. For example, many communities had issues around adequate temporary housing space for healthcare workers and individuals exposed to the virus and needed to quarantine. Using this pattern, community members could come together to provide RVs or unused accommodations for this purpose. For example, people with web development skills could create a website for people with unused RVs or lodging to connect with someone in need of their resource. At a community level, it is integral to connect people with different abilities for disaster relief; their combined synergies can be greater than the sum of individual capability.

The *virtual third place* pattern re-imagined physical third places frozen due to the pandemic. Online third places can sustain and build social bonds for local community members. They provide a place for people to have a conversation on local topics, share experiences so as to develop a support network, learn about local art and culture, explore familiar locations that have suspended their in-person operations, and express themselves to other like-minded people. Not only does this pattern preserve pre-COVID-19 third places (e.g., library book clubs, local festivals, fitness centers, museums, local community spaces), it also creates another form of third places that are different from traditional ones. For instance, one of the third places we observed was a public gallery website where people can emotionally connect with neighbors through paintings and writings. This pattern can be used otherwise to revive ambiance in libraries through opening virtual studying halls on public websites, where

they can casually come in, turn their cameras on, and see others studying at home during the lockdown era. They can feel that they are not the only ones who have to study staying in their room throughout the crisis, and others are also undergoing the same difficulties. Emotion sharing and interaction with others in third places becomes more significant in more prolonged disasters when helplessness and anxiety are prevalent. People can discuss collective matters with others experiencing a similar tragedy or escape disastrous reality for a moment with others who share similar interests. They can feel that they are not alone. For the greater community, collective discourse and bonding can direct people to renew their commitment to their community as they share a common symbolic space that emphasizes collective goals and values [38, 48].

Pattern Language for Improving Community-based Disaster Relief

Our process of developing civic initiatives into patterns sheds light on how to facilitate efficient community effort for disaster relief from both a theoretical and practical perspective. Theoretically, our methodology contributes to the formulation of new pattern language based on empirical activities that are already being performed in the real world. We collected a set of existing civic initiatives, clustered them based on affinities, conducted in-depth interviews to understand their impacts and operational strategies better, and identified commonalities across multiple civic initiatives to develop each element of the two pattern languages. In Section 3, Figure 1 details our step-by-step approach. Framing empirical examples of civic disaster relief into pattern language generalizes insights and provides a concrete solution schema applicable for disaster relief in similar situations. Pattern language for community-based disaster relief mitigates issues of abstraction and generalizability in case study research, which is a typical method for understanding civic disaster recovery. Case studies are used to deliver an in-depth understanding of a complex issue in its real-life context, such as how citizens helped their neighbors cope with a disaster, but are usually too detailed to elicit wide practical application. We see pattern language as a way to expand the contributions of case studies by codifying them into patterns for future reuse.

Practically, when a disaster occurs, citizens can refer to and employ patterns that were derived from previous similar disasters. Feasibility of a pattern that is developed following our methodology is already proven in that it is developed based on civic activities that were

already practiced in the real-world. Citizens in crisis can identify pattern language for a similar *problem* that needs to be solved, use an existing pattern to implement a workable *solution*, consider *forces* that can influence the effectiveness of the response, and track a possible *resulting context*. For instance, in Section 5.1, we explored how the two patterns presented in this paper can be extended and applied to other contexts. To our knowledge, prior research has not incorporated a set of community-based disaster relief into pattern language, which can guide citizen behaviors in the future.

Limitation

We presented two patterns for community-based disaster relief to resolve immediate problems that arise at the beginning of the pandemic crisis. However, we acknowledge that discussed two problems are not the only problems in the early phase, and there can exist other solutions that can solve the two problems addressed in this study. Furthermore, different problems can arise depending on the time frame of the pandemic era. Our data set included 13 civic initiatives that existed in various areas in the United States at the beginning of the pandemic, which contributed toward a wide range of local needs. Future studies could observe additional initiatives from other regions and at different points of time during the pandemic. This could refine and strengthen pattern language for community-based disaster relief, as well as provide socio-cultural context.

CONCLUSION

This study demonstrates that citizens can effectively contribute towards disaster relief, such as that required by the COVID-19 pandemic. We introduce two patterns for immediate social problems that can occur in the initial phase of pandemics, the *local expert network* pattern and the *virtual third place* pattern. We articulated the methodology for developing pattern language from empirical data in civic disaster relief. Disaster relief schemas written following pattern language are reusable and provide a baseline approach for dealing with future similar disaster scenarios. Future studies can follow the procedures we laid out for creating new patterns, which would broaden the repository of patterns in community-based disaster relief.

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A INTERVIEW PARTICIPANT DETAILS

Table 3: Interview Participants and Civic Initiatives

	P	R	Pattern	Initiative Description
Participant	P	R	Pattern	Initiative Description
1	organizer	Expert Network	Local	Local experts manufacture personal protective equipment for front-line healthcare workers
P2	organizer	Local Expert Network		A group of students sends isolated local nursing home residents a video showing different talents for encouragement
P3	participant	Local Expert Network		A group of students sends isolated local nursing home residents a video showing different talents for encouragement
P4	organizer	Local Expert Network		Public transit agency does delivery for the vulnerable, volunteers do grocery shopping, restaurants provide free meals, and local businesses manufacture PPE for volunteers
P5	organizer	Local Expert Network		The group serves as an intermediary between the vulnerable who must stay in shelter and others who can provide donations or do delivery
P6	organizer	Local Expert Network		The group delivers local restaurant food donated by locals to healthcare workers and hungers, and local businesses or individuals raise online fundraising events
P7, P8, P9 *	organizer	Local Expert Network		The group collects laptop donations and distributes to people without computers
P10, P11 *	organizer		Virtual Third Place	Local

community space for artistic and community events provides an				
interactive online platform to host virtual events	P12, P13	organizer	Virtual Third	
Place		Online group fitness classes		
P14		organizer	Virtual Third Place	Online
platform where local neighbors can share their artworks or				
writings that reflect their experience during the pandemic				
P15, P16	participant	Virtual Third Place	Online platform where local	
neighbors can share their artworks or				
writings that reflect their experience during the pandemic				
P17, P18 *	organizer	Virtual Third Place	Local public	
library holds virtual events (e.g. book clubs, storytelling,				
author talks)				
P19, P20 *	organizer	Virtual Third Place	University art	
museum holds virtual events (e.g. gallery talk, virtual				
tours, art drawing sessions)				
P21	organizer	Virtual Third Place	Local arts	
festival held virtual events for three days (e.g. live music				

performances, art exhibition, dance class)

* These interviewees were interviewed in the same session.