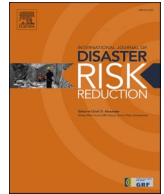




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Exploring residents' expectations and designers' perspectives towards post-earthquake permanent housing: A case study in Antakya

Berk Göksenin Tan ^{*}, Oğuzhan Özcan

Arcelik Research Center for Creative Industries (KUAR), Koc University, Istanbul, Turkey

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ABSTRACT

Post-disaster permanent housing is the backbone of the recovery efforts after destructive events. It holds great potential to adopt new technological innovations and to provide improved conditions for these everyday spaces. However, previous investigations suggest that these housing projects lack consideration of the inhabitants' expectations, needs, and values due to environmental, cultural, and social factors, resulting in a dissatisfactory built environment. Following the Kahramanmaraş earthquake on February 6, 2023, this research aims to explore the expectations of affected residents in the historic district of Antakya. We expect to contribute to decision-makers, designers, and the technology industry to develop more user-centered housing recovery efforts in the aftermath of these devastating events. The findings revealed four implications from the expectations for post-earthquake homes: (1) designing for togetherness, (2) valuing community efforts and traditional work, (3) including productional activities, and lastly, (4) preserving and reminiscing heritage values. Additionally, we discussed these four implications with multi-disciplinary designers to expand the discussion space for designing post-earthquake permanent homes in Antakya. Overall, these implications suggest some future architectural changes in homes as their residents' expectations, including the creation of new heritage and production spaces using digital, physical, and mixed reality technologies, as well as the emergence of new social gathering spaces. By conducting a case study in Antakya, our research highlights the potential for the further development of post-disaster permanent homes that not only provide shelter and safety but also enhance the overall quality of life for the residents, both for Antakya and the other relevant cases worldwide.

1. Introduction

On February 6, 2023, a devastating earthquake measuring Mw 7.8 struck southern and central Turkey and northern and western Syria. With its epicenter located north-northeast of Kahramanmaraş, the earthquake wreaked havoc in the region, resulting in more than 52,000 losses of life and widespread destruction. The seismic event was followed by another powerful earthquake, measuring Mw 7.6, later in the day [1]. After 14 days, on February 20, 2023, a third earthquake of Mw 6.5 occurred near Antakya, about 100 km south of the first epicenter. These consecutive disasters impacted more than ten cities within its epicenter. However, one of the heavily affected areas was Antakya, the capital of Hatay Province, where the earthquake registered a maximum Mercalli intensity of XII around

^{*} Corresponding author.

E-mail address: btan20@ku.edu.tr (B.G. Tan).

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the epicenter and within the city itself [2]. According to the government report, the most destruction in the earthquake occurred in the province of Hatay. In the report, it is stated that many buildings were impacted in Antakya, with 847,380 residential and 1108 cultural heritage buildings within the province of Hatay [3]. Although Antakya is a challenging area to design for post-disaster permanent housing projects due to its complex historical and social structure, the rebuilding process was urgently initiated in the aftermath of the catastrophe [4].

The reconstruction efforts after disasters present an opportunity to reimagine the architectural design of these post-earthquake homes better for the recovery process [5]. Especially in the case of technological innovations within these newly built spaces, these efforts hold great potential to adopt new technological innovations and improve conditions for these everyday spaces [5,6]. Following the Kahramanmaraş earthquake, ministry-initiated projects, such as a smart post-disaster permanent housing near Nurdağı, Gaziantep, indicate these attempts [7]. However, these innovative architectural approaches are mostly criticized for being top-down and neglecting residents' expectations, needs, and values for these new homes [6]. It is also essential to acknowledge that the architectural design process has previously been criticized for lacking user perspectives, particularly during its early planning phases [8]. Unfortunately, as prior studies also highlighted, the resulting structures may not fully cater to the needs and expectations of the inhabitants due to environmental, cultural, and social factors [9,10]. Therefore, studies examining residents' expectations, needs, and values towards designing post-disaster permanent housing remain scarce in the field.

To address this crucial aspect, user-centered design approaches hold valuable potential for overcoming the issues in post-disaster housing design efforts [11]. Hence, this research examines the expectations, needs, and values of the earthquake-affected residents of Antakya, who are also early adopters of domestic technologies, to obtain insights into designing post-earthquake permanent housing in Antakya. In light of this aim, we conducted in-depth semi-structured interviews with 10 early-adopter residents of Antakya who were affected by the Kahramanmaraş earthquake. By engaging with individuals who are familiar with advanced technological innovations in their homes, we sought to gain valuable insights into their expectations, needs, and values towards more resilient future residences.

Furthermore, we investigated whether these insights from the interviews fostered the ideation and inclusion of different stakeholders by conducting two focus group sessions with ten multi-disciplinary designers. In these focus group sessions, we presented these insights to five architects and five interaction design researchers to investigate whether these insights support idea generation within multi-disciplinary designers' perspectives for the rebuilding process. By obtaining these insights from residents and designers, this research expects to generate some implications for the design of the post-earthquake permanent housing in Antakya and reveal novel directions for future technologies in this context.

Significantly, we contribute these important aspects by conducting this research; by delving into the user perspectives and incorporating them into the architectural design of post-earthquake housing, our findings strongly advocate for the development of homes that not only provide shelter and safety but also enhance the overall quality of life for the residents of Antakya. Consequently, this research initiates an effort for decision-makers, designers, and the technology industry to develop post-disaster permanent housing projects and technologies that are more user-centered. Moreover, these implications could further support enhancing the disaster-affected individuals' everyday comfort and interaction within their homes by providing them an opportunity for a more positive post-disaster recovery experience.

2. Related work

2.1. The role of post-disaster permanent housing in recovery efforts

In the aftermath of disasters (e.g., earthquakes, floods), recovery efforts are the most fundamental point of disaster management and are expected to occur at an immediate level. It is a complex process that involves the interaction of social, technological, and economic factors [12]. In the process of the recovery effort following a disaster, governments, and humanitarian aid organizations typically offer temporary or transitional accommodation during the emergency response and relief stages for disaster-affected residents, and later, the construction of permanent housing is initiated during the rehabilitation and reconstruction stages (see Fig. 1) [13]. Housing bears a significant burden of economic losses, accounting for up to 62 % of the total losses resulting from disasters [14]. Thus, housing restoration is considered vital for recovery since it significantly impacts the various aspects of individual, household, and community recovery [15].

Moreover, it is crucial to recognize that the loss of homes goes beyond the physical structure for those affected by disasters. Homes represent a place where people carry out daily activities, perform domestic chores, and establish their livelihoods [16]. Previous research indicates that a house cannot be defined by any of its functions and can only survive as long as it fulfills the needs of its residents [17]. In the context of post-disaster housing, one study explores the importance of house and home for survivors and extends the meaning to not only its protective measures from hazards but also its direct impact on health, well-being, and security [18]. Hence,

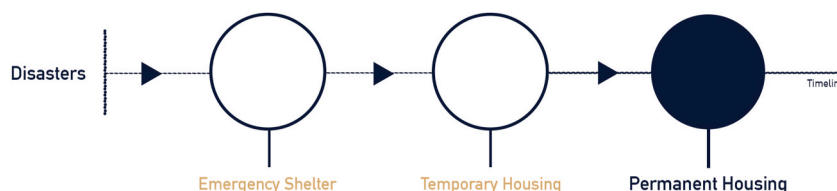


Fig. 1. The process of rebuilding efforts after disasters.

following an earthquake, a significant challenge lies in providing affected individuals with new residential areas that not only restore their physical environment but also address their psychological, social, and economic needs [19,20].

2.2. The importance of user expectations for post-disaster permanent housing

The main concern following an earthquake should comprise providing individuals whose psychological, social, and economic integrities were harmed housing with more improved conditions [21]. However, the issues that occurred at these previous attempts at post-disaster housing resulted in a sense of uncertainty and insecurity, reduced quality of life, and a lack of trust and transparency regarding the policies and procedures by the residents in the earthquake area [22].

The risks of permanent housing projects built after earthquakes and the long-term satisfaction of occupants are frequently examined in terms of environmental, sociocultural, and psychological factors [23–25]. Many disaster-impacted individuals see the recovery process as returning to normal, meaning regenerating the lives in their pre-existing homes and neighborhoods [26]. However, Haigh's study underlines that post-disaster permanent housing resettlement caused new conflicts and tensions among individuals who came to live, and it is essential to understand and preserve the communal values of these residents in the rebuilding process [27].

Unfortunately, many studies investigating housing design and its environmental factors deliver results of dissatisfied residents with their post-disaster permanent homes [28–30]. It is observed that occupants of these spaces had to adjust the plans of their homes by changing room functions and adding or removing new spaces to provide adaptations to their lifestyles [31]. Therefore, the reconstruction of homes does not solve the housing issue by itself, and it is crucial to investigate indicators that can transform a house into a home and the surroundings into a neighborhood [25]. Because buildings' physical environment influences a person's everyday existence, social relationships, psychological circumstances, and the operation of the socioeconomic system. Furthermore, comfort conditions based on physical environment factors are critical in improving environmental satisfaction in post-earthquake permanent housing projects [21]. Another research describes, through the resettlement process, social and cultural appropriateness is also vital for successful outcomes [32]. In light of these, the expectations, needs, and values of those who are impacted by a disastrous event should be taken into consideration for the design of post-disaster permanent housing projects.

2.3. The notion of people-centered housing recovery

The dominant approach of top-down constructor-driven reconstruction in post-disaster housing reconstruction has received significant criticism [33]. This approach, while prevalent, lacks adequate community engagement and fails to recognize the diverse needs and priorities of affected populations. These shortcomings raise doubts about the top-down approach's ability to support recovery efforts and foster resilient communities [34]. A critical factor contributing to the failure of post-disaster permanent housing projects, as highlighted by Sadiqi [10], is the disregard for local needs and culture. As Dikmen also identifies typical top-down design approach supplied by the government resulted in high dissatisfaction among the residents [28]. Prior research strongly recommends incorporating provisions for permanent housing, considering its long-term impact from a people-centered perspective [35].

As Maly described, although the term "people-centered" has gained momentum in recent years within the domains of development and housing reconstruction [11,36,37], housing experts and international agencies have advocated the concept of placing people at the core of housing recovery since the 1970s. Shaped by John Turner's ideas, this perspective emphasizes the empowerment of residents, with residents taking charge of their own housing and reconstruction. In that way, it gives the disaster-impacted residents more agency and control over decision-making. Hence, housing is not viewed as a mere product but as a transformative process that can empower individuals [38]. Aligned with these recovery approaches, this research provides a fundamental initial step toward designing people-centered post-disaster permanent housing in Antakya.

2.4. The role of technology in disasters

Technology could play a crucial role in different disaster management stages, such as disaster response, recovery, preparedness, and risk reduction. Especially in the recovery phase, technology could significantly enhance the efficiency and effectiveness of response efforts. For example, Harnesk described how beneficial technology could be in terms of coordinating available resources [39]. Other studies highlight the importance of drones in the connectivity of the relevant bodies in times of crisis and disaster events [40]. Other studies claimed the importance of geographical information systems (GIS) [41] and the potential uses of artificial intelligence (AI) [42] to support the disaster management stages. Most importantly, prior research by Shklovski et al. underlines the importance of technology in terms of community recovery for connecting individuals in post-disaster times [43]. Moreover, previous studies also acknowledge the importance of the use of technology in the means of preserving and reconstructing both tangible and intangible heritage values in the aftermath of disaster events [44]. Therefore, in the scope of this research, the expectations of earthquake-impacted residents of Antakya for the post-disaster permanent homes and the rebuilding efforts could consider different ways of technology in terms of resilience and response.

3. Case study context

Antakya, also known as Antioch, is the capital of Hatay province and is located in the southeast of Turkey, near the Syrian border (see Fig. 2). Its history dates to 300 BC. and was founded by Seleucus Nicator I near the Lake of Antioch (Asi Nehri) [45]. It was once called the 'Queen of the East' since it is historically notable for being an early center of Christianity and one of the capital cities of the Roman Empire [46]. It was also home to many civilizations, from Roman Empire and Byzantium to the Ottomans and the French [47]. As a result of this historical significance, the area has been formed and reformed over time by different civilizations, resulting in the co-existence of many structures from various periods as its tangible heritage values [46].

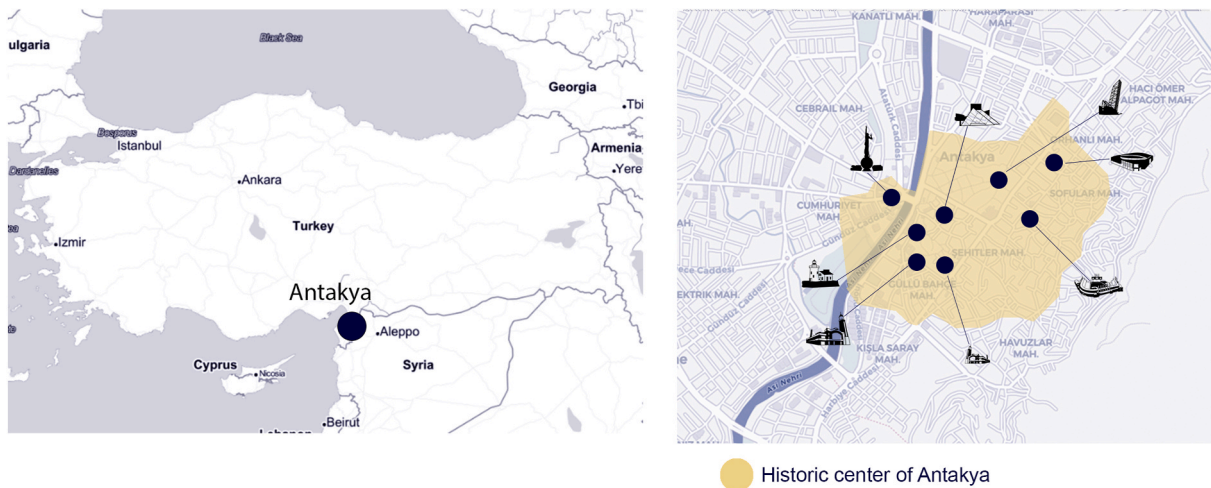


Fig. 2. Map of Antakya.

With such historical importance, Antakya has site-specific experiences for its residents (see Fig. 3). In terms of its urban neighborhoods, as the prior study highlights, a particular characteristic brings site-specific values (e.g., the experience of street patterns) to its residents [48]. In addition to its neighborhoods, the traditional houses with region-specific characteristics have always been a different indicator of this rich history [49]. These traditional houses have a specific spatial organization and a prominent atrium [50]. Even though previous research indicates that these traditional homes were adapted to the current needs of their residents, their authenticity and historic values remain significant [51].

Moreover, as Doğruel et al. stated, Antakya has a multi-ethnic and multi-cultural character, and such composition is directly reflected in diverse cultural community practices [52]. These traditional intangible heritage practices result in specific spatial requirements such as olive oil and soap production [53]. This cosmopolitan structure extends into rich ethnomedical information and practices as its heritage values [54]. The prior study indicates a strong attachment by its residents to the urban identity, which describes a complex and rich social relation among its community members [55].

To understand the morphological structure of the city, Topcu et al. [56] described that there are two different dimensions related to the city structure; the old city and the new city intertwined with each other at certain points. The old city pattern appeared within 2300 years, and the new city pattern appeared within 100 years. In Antakya's residential areas, the two prominent typology of the housing is first the traditional Antakya houses, which appeared to be either single landed or attached, and second the apartment units, which also appeared to be either single landed or attached [57]. From the holistic understanding of heritage [58], both parts of the city consisted of important historic values for both the residents and their post-disaster permanent homes. We also aimed to consider both in our investigations to deepen our understanding from the residents' expectations.

Unfortunately, the area has witnessed numerous earthquakes that caused major destruction in the region resulting in undesirable consequences for its urban life [59]. For instance, as Rifaioğlu suggested [60], Antakya has adapted their building construction as apparent in its traditional homes, through coffered walls and ceiling that are proven to be more resistant to earthquakes. Another study also described the traditional homes are mostly built with Baghdadi technique, generally two-story with thick main walls, and the upper floors are light construction [61]. Even though, the government regulations were set to be tight in Turkey, after the 1999 Izmit Earthquake, it is stated that in some cases, newly constructed buildings collapsed due to the widespread corrupt practices, while older buildings remained standing due to their specific architectural technique [62].

The impact of the 6th February Kahramanmaraş earthquake caused severe destruction from homes and commercial buildings to historic buildings (see Fig. 4). According to the government report, the province of Hatay suffered the most damage from the



Fig. 3. Antakya after the earthquake events. Source: collage made by the authors.



Fig. 4. Antakya before the earthquake events. Source: collage made by the authors.

earthquake. The report shows that many buildings were impacted in Antakya, with 847,380 residential and 1108 cultural heritage buildings within the area [3]. Most of the damages detected in the region; have shown that it is caused by structural irregularities, inadequate quality of building materials, poor workmanship, and practices that do not comply with Earthquake Regulations [63]. Especially, in the case of reinforced concrete buildings in the region is described to witness severe damages after the Kahramanmaraş Earthquake, due to their poor workmanship, technological limitations leading low material quality (especially concrete), improper structural framing, a common appearance of soft and weak stories, the inadequate use of shear walls, and defective reinforcement configuration [64]. These factors inevitably showed how vulnerable the region was in the context of its building codes, regardless of its long history with many earthquakes.

Aligned with our research focus, a preliminary analysis of the attempts of ministry-initiated housing projects such as TOKI has shown that contemporary design strategies and residents' expectations lack a meaningful encounter [50]. As Ergün et al. suggested that these mass housing projects initiated by the ministry consisted of multi-story, plain, uniform concrete blocks, as found to be less authentic by the residents, and stated to lack a prominent relationship with architectural heritage and traditional residence [65]. Furthermore, residents were less satisfied with privacy aspects in the ministry-initiated apartments, considering that traditional homes offered more privacy through their unique architectural qualities of spatial arrangement and atria. Also, the traditional homes were found better for responding to changes in family structure as the traditional homes appeared to be more extendable than the modern, ministry-initiated high-rise buildings. These factors are valuable for inclusion in the case for designing future homes in the region. The study further suggests that cultural values should be adapted to future housing designs to sustain the cultural heritage values in Antakya [50]. As highlighted in the related work section, we also realized a high level of dissatisfaction as we examined the previous studies investigating disaster-affected residents' satisfaction with post-earthquake permanent housing in the Turkish context [21,28,29]. Previous studies also highlighted the dissatisfaction factor from the post-disaster permanent housing projects in Turkey. One study showed that these factors appear as the current neighborhoods' environments' difference from the pre-disaster one and weakened social ties [30]. Another study highlighted the importance of housing design, such as investigations showed that residents expressed high level of dissatisfaction with certain elements of their homes, such as balconies, storage spaces [66], and residents intervened to change the form and interior [16]. Therefore, the costum designs of these housing project where residents were more involved in the design process was found to overcome this dissatisfaction in a certain level [28]. Hence, socio-cultural values as design inputs for post-disaster permanent housing in Antakya could support increasing its residents' satisfaction level.

4. Method

We initiated the study procedure with an extensive review of the existing studies. After that, the data obtained for this research is collected using a qualitative approach (see Fig. 5). The qualitative approach started with in-depth semi-structured interviews to obtain deeper insights into the disaster-affected residents' expectations, needs, and values. We conducted these semi-structured interviews with ten residents of Antakya who scored as an early adopter or innovative on the Innovativeness Scale (IS) [67,68]. IS was used to identify whether the participants were familiar with recent technological developments or more likely to adopt new technological artifacts. Although there are several scales specifically developed for measuring technology familiarity in terms of individuals innovativeness level [69], we preferred to use Hurt's Innovativeness Scale for its wide adoption [70] for the previous research to examine the context of technology use in the home setting [71–73]. For instance, prior studies frequently associate the individuals' technology familiarity with IS scale via describing that individuals with higher innovativeness level are more comfortable coping with uncertainty [74] and are more risk tolerant [75]. It is also stated that individuals with higher IS deliver more insights on future changes in architectural design [76]. Another study claimed the importance of these individuals for establishing a more meaningful connection with their built environments [77]. Moreover, for the second part of this research, we conducted two focus group sessions with five practicing architects and five multidisciplinary interaction design researchers. The focus group sessions aimed to identify if the interview results triggered ideation and, in terms of diversity of ideas, in what ways different stakeholders discussed common or different points during the sessions. These sessions further helped us employ the implications for designing the post-earthquake permanent housing in Antakya.

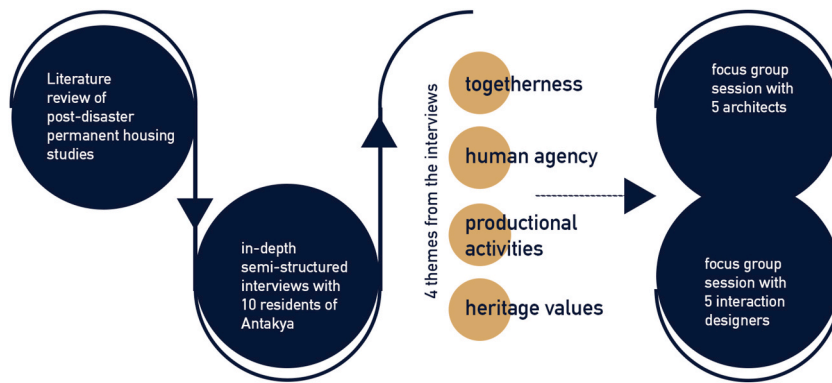


Fig. 5. The research process.

4.1. Participant recruitment

For interviews, within a month after the 6 February Kahramanmaraş earthquake, we recruited the participants via Koç University’s general directory of students. We openly invited all students at the university who was impacted from the earthquake events in Antakya, and in return we received ten students who expressed their interests to participate in the interview sessions. Upon convenience sampling [78] and prior studies exploring within the similar scope of our research [76], we decided to number of students were rich enough to deliver insightful data for our investigation. For those who showed interest in participating, we then deployed a survey including the Innovativeness Scale (IS) [67,68] to understand if the resident is an early adopter or above. A total of 10 participants agreed to join the study. All are undergraduate students, four males and six females, and their ages ranged from 19 to 22 (see Table 1). We specifically aimed to obtain expectations from the younger householders as the previous study suggests that they tend to dislocate from the post-disaster permanent homes in the aftermath of a disaster [79,80]. Consequently, the common criteria among the interview participants are as follows: they are all residents of Antakya who were affected by the Kahramanmaraş earthquake events; They all indicated that the earthquake impacted their existing homes severely, and they scaled as early adopters or above from the IS survey.

For focus groups, we conducted two sessions. Both sessions are conducted with design-oriented participants, as previous research also shows the importance of their input for disaster response and recovery [81]. The first session (FC1) included five architects who had experience for more than five years in the field (see Table 2). The architects were recruited through the authors’ network for their specific practice interests and expertise within the field (e.g., working with architectural conservation, actively participating in the recovery efforts in Antakya, or an architect who is a resident of Antakya) to support the richness of the discussions. The second focus group (FC2) study session included five multi-disciplinary design researchers who actively work in the interaction design field (see Table 2). Aligned with the recruitment of the FC1, we recruited participants for FC2 upon their specific research interests and expertise (e.g., human-building interaction researcher, more-than-human interaction researcher). Various research interests within the design discipline helped us obtain deeper and expertise-specific data from the discussions.

4.2. Study procedure and analysis

Interviews:

We conducted the interview sessions either face-to-face (8 participants), or online via Zoom and Miro applications (2 residents) based on participant’s preference. Each interview session consisted of three parts. In the first part, we asked participants questions to understand their relation to Antakya and the neighborhood they reside in. We provided a map of Antakya and asked them to locate their home and important points within their neighborhoods. This part helped us identify the factors such as their attachment, their pre-disaster experience and pain points within our research location. In the second part, we aimed at revealing the meaning and context of home for the residents and investigated their previous experiences of technology use within their domestic spaces. For the

Table 1
Interview participants.

Interview Participants	Age	Gender	Earthquake impact to the existing home	Household status	Location of residence
P1	22	Male	Severe	Homeowner – lives with family	Antakya and Istanbul
P2	21	Male	Severe	Homeowner – lives with family	Antakya and Istanbul
P3	20	Male	Severe	Homeowner – lives with family	Antakya and Istanbul
P4	20	Male	Severe	Homeowner – lives with family	Antakya and Istanbul
P5	21	Female	Severe	Homeowner – lives with family	Antakya and Istanbul
P6	20	Female	Severe	Homeowner – lives with family	Antakya and Istanbul
P7	19	Female	Severe	Homeowner – lives with family	Antakya and Istanbul
P8	21	Female	Severe	Homeowner – lives with family	Antakya and Istanbul
P9	22	Female	Severe	Homeowner – lives with family	Antakya and Istanbul
P10	20	Female	Severe	Homeowner – lives with family	Antakya and Istanbul

Table 2
Focus group participants.

Focus Groups	Participants	Recruitment Criteria
Session 1	FC1-P1	She is a resident of Antakya who is affected by the earthquake. She practices as an architect in Antakya for more than 5 years.
	FC1-P2	She practices architecture for more than 5 years, works in historical buildings preservation and restoration.
	FC1-P3	He practices architecture for more than 5 years and designs historic buildings with adaptive reuse.
	FC1-P4	She practices architecture for more than 5 years, mainly focuses on architectural design competitions.
	FC1-P5	He practices architecture for more than 5 years and is an expert for restoration and renovation projects.
Session 2	FC2-P1	She works in the field of human-building interaction, focusing on future of housing and urban design.
	FC2-P2	She works in the field of more-than-human-centered design, focusing on plants and agricultural activities.
	FC2-P3	He works in the field of human-computer interaction, focusing on embodied interaction with technologies.
	FC2-P4	She works in the field of human-computer interaction, focusing on VR/AR spatial design and experiences.
	FC2-P5	She works in the field of human-computer interaction, focusing on future domestic food practices.

last part of the interview, we asked questions about their expectations from post-earthquake permanent housing in Antakya, and their preservation values throughout this rebuilding process. During the interview sessions, participants were highly encouraged to think-aloud technique [82] to comfortably express their thoughts about the subject. During the interview sessions, we carefully avoided any question that may cause our participants to feel emotionally vulnerable.

After the interviews were completed, we transcribed the recordings, and coded our data inductively. The interview data is analyzed using reflexive thematic analysis approach [83]. The reflexive thematic analysis approach consists of six phases as prior research also suggested: familiarization with data, generating initial codes, generating themes, reviewing potential themes, defining, and naming themes, and lastly, producing the report [84]. Throughout, the process was iterative, and we discussed the outcomes with three other researchers in a meeting that lasted approximately 5 h in total. Potential disagreements throughout the analysis process have been discussed extensively, and the conflicts about the coding procedure, emerging themes, and the ambiguity associated with respondents' statements have been concluded upon consensus.

Focus Groups:

After the themes of residents' expectations had emerged from the interviews, we further aimed to investigate in what ways these insights fostered ideation among different design-oriented participants. Therefore, we conducted two focus group sessions with architects (FC1) and multi-disciplinary interaction design researchers (FC2). We started with a brief presentation describing the research context in both focus group sessions. We then asked our participants to discuss the design of post-earthquake permanent housing in Antakya to initiate the thinking process. Furthermore, we provided the themes interpreted from the interview sessions with earthquake-affected residents of Antakya in the form of design prompts [85]. Based on the design prompts we provided, we asked our participants to discuss and ideate in the context of designing post-earthquake permanent housing in Antakya. Lastly, we asked our participants to reflect on the overall process for ideating from the interview themes to reveal the concluding points of the focus group sessions. We conducted the FC1 online using Zoom and Miro applications, because participating architects were residing in different locations, and unable to physically meet (For instance, FC1_P1 was in Antakya at the time of the study). For the FC2, we conducted the session physically since all participating designers were able to meet, and via Miro for participants to document their discussion points. Since one focus group session was online and the other was physical, we aimed to replicate the procedure as possible to increase the consistency of the data we obtained. Each focus group session lasted approximately 90 min and was audio recorded. After the sessions, we analyzed transcribed recordings and Miro boards using reflexive thematic analysis following the steps mentioned above [83].

5. Findings

5.1. Residents' expectations towards designing post-earthquake permanent housing in Antakya

5.1.1. Theme 1: Togetherness

Throughout the interview sessions, most participants expressed a strong attachment to their neighborhood community in Antakya. The experience is further described through living and sharing common spaces as well as domestic spaces. P9 described having a common space within her home where she could cook and spend time with other family and community members. P4 stated, "*The neighborly relations are very important here, both within the neighborhood community or among the residents who share the same apartment block.*" Even, two participants mentioned to inhabit an apartment that they purposefully built to live together with other family members such as grandparents, cousins, or other siblings. It was prominent that while expressing their expectations from the post-earthquake permanent housing in Antakya, residents wanted to create places for being together or access technologies that support their community lives. As highlighted the value of sharing within the community, participants openly expressed that shared technologies might be well adopted within future domestic spaces.

One breakdown point of this theme also includes the sense of security, primarily described in the context of togetherness. Most participants described their pre-disaster experiences within their neighborhoods as *very secure* because the community members had a very close relationship with each other. P7 described, "*As I walk in the street, I know everyone in the neighborhood, and this gives a feeling of security. I like this sense of belonging to my neighborhood.*" Therefore, residents of Antakya remarkably mentioned that they expect to have post-earthquake permanent homes that provide this security feeling just as their pre-disaster experiences within their neighborhoods.

5.1.2. Theme 2: Manual and traditional works

Even though residents were at a high adoption rate with technological innovations, they highly valued manual and traditional works for the domestic chores as their relationship with technology use and automation at home. During the interview sessions, participants described having traditional ways of making at home, which they mostly expected to preserve within the technology-enhanced domestic spaces of post-disaster rebuilding. P8 stated, *"We do not use an automated Turkish coffee machine, especially my grandmother. She says preparing and mixing it in the copper pot is more delicious. These traditional values are important to preserve"*. It was significant that participants expected to have technology in the future domestic spaces that have high human agency over its use and the traditional values integrated.

5.1.3. Theme 3: Community efforts

In addition to those mentioned above, the community efforts used for preserving and creating heritage values is also highly cited. P6 described her grandfather as directly helping over the archeological excavation of a sarcophagus in Antakya, to which she felt a strong attachment. In the same way, P9 referred to the historic houses of Antakya (one of them was her residence) as *"I would like to preserve what appears to be a result of community effort"*. Therefore, the residents expected to participate and have agency in the building process of post-earthquake housing in the city. Through the rebuilding efforts of historic locations such as Antakya, integrating community efforts of the earthquake-affected residents is also expected to positively contribute to the individual well-being after the earthquake.

5.1.4. Theme 4: Production aspect

During the interviews, most participants described integrating some production activities within their domestic spaces, referring to their pre-earthquake experiences. These activities varied from soap-making to small/mid-scale at-home/indoor cultivation. P1 described, *"Everyone has something to plant and harvest at home, so we need to protect this routine because we put them in our meals."* In the same context, most participants stated their expectations to integrate these production activities into the post-earthquake permanent housing spaces in Antakya. In line with this, P7 also highlighted the importance of daphne soap-making as a traditional activity that needs to be adapted into the design of post-disaster permanent homes in Antakya. These points expressed by the residents are very valuable in considering the importance of the livelihood of the residents in the case of the post-disaster phase. Thus, considering their pre-disaster routines, residents of Antakya pose a must-integrate condition of being able to conduct these activities in their newly built homes after the earthquake for the livelihood of the individuals.

5.1.5. Theme 5: Heritage values

As previously described, Antakya is a historically significant due to its rich tangible and intangible heritage values. There was a certain sense of trust towards tangible heritage values such as historic buildings. As expressed of feeling more secure, the participants described the stories of their older siblings for the trusting their traditional homes, as the thick walls were protective against earthquakes. Participants mentioned their instances of appreciating these tangible and intangible in the city, and during the interview sessions, preserving the heritage values after such destruction was a fundamental step for the residents of Antakya. Expectations for these heritage values within the context of technologically enhanced future domestic spaces were mainly described through the ability to re-experience these using technologies. The chance of re-experiencing these heritage values of the pre-disaster era, specifically tangible values such as historic buildings, was an attainment that future generations are expected to achieve, as described by P5. In line with this, P10 also stated her expectation for post-earthquake permanent housing design in Antakya, *"We should be able to re-experience the feeling of the old bazaar of Antakya from our homes, maybe using VR or some kind of similar technology."* Therefore, it was a common expectation for post-disaster homes to support these heritage experiences for preserving or conveying to future generations.

Moreover, the residents' expectations for preserving the tangible and intangible heritage values extend into preserving with the use of technology. During interviews, participants stated their salient attachment to the heritage artifacts, such as historic doorbells of the traditional Antakya houses. They wanted to extend the use of these heritage artifacts by adapting them into technologically enhanced products. P5 described, *"The historic doorbells should be preserved. Maybe, we can integrate some sensors into it to turn it into a smart security system and keep using in our future homes"*. Hence, it was a significant expectation for the residents of Antakya to preserve heritage artifacts using technology.

5.2. Insights from focus group sessions with architects and interaction design researchers

After generating themes from the interview data, we conducted two focus group sessions with architects and design researchers. During these two focus group sessions, all participants were able to generate ideas based on the interview findings for designing post-earthquake permanent housing in Antakya.

The discussion throughout the two focus group sessions resulted in three common points. The first and most prominent content in the discussions was for developing and integrating new technological artifacts in the context of post-earthquake permanent housing in Antakya. These ideas ranged from implementing waste management technologies in domestic spaces (FC1) to smart tools for storing heritage values to prevent loss over disaster (FC2). The hierarchy for identifying the urgency of post-earthquake rebuilding policies is also discussed in both focus group sessions. For example, in FC1 and FC2, the participants highlighted that expectations for feeling secure might lessen over time, as it was an essential concern residents pointed out during the interviews. Therefore, it was discussed that the new security technologies in the post-disaster permanent homes might adapt to the changing security concerns of residents over time and in different circumstances. In addition, participants of both focus group sessions identified potential impacts and

concerns of the new technologies they ideated for the future of housing in Antakya. These discussion points were if any of the ideas in the FC sessions may result in gentrification or loss of certain parts of the neighborhoods (e.g., the traditional shopping districts).

Furthermore, each focus group session has uniquely contributed to the content of discussions based on the residents' expectations of post-earthquake housing for Antakya. For FC1, architects revealed significant discussion on generating new plan schemes and architectural functions for the post-earthquake permanent housing design. These ideations appeared to consider such as, new plan schemes and new architectural functions within single apartment unit that is speculatively located in the historic core of Antakya. These examples include some novel open-plan solutions for domestic spaces or future rehabilitation spaces that are integrated into the housing plans in Antakya. For instance, these ideations including future rehabilitation spaces were considered more in a speculative housing complex located within the neighborhood scale. In FC2 for interaction design researchers, the discussion points extended into organizational schemes to increase community resilience for the post-disaster rebuilding process. Such a point was described to create an organizational scheme that includes the production, storage, and sharing of local products from post-earthquake permanent homes of the individual. The importance of such a organizational system was also discussed for its potential to preserve and share the intangible heritage values of Antakya. They also discussed generating new interaction modalities for the technologies in future homes of Antakya. The participants discussed the idea of an interactive wall built in the post-earthquake permanent homes for the context of multi-sensory experiences (auditory, tactile) with domestic spaces that supports re-experiencing these heritage values. This speculative interactive wall is considered for its use in both in single apartment units to be owned by residents individually, and in a neighborhood scale, which includes a wider community of residents in Antakya.

6. Discussion

This research consists of a case study of residents' expectations toward designing post-earthquake permanent housing and how these expectations trigger discussion among design-oriented actors. As a result of this investigation, we revealed four practical implications for post-earthquake permanent housing: (1) designing for togetherness, (2) valuing human labour, (3) including production activities, and, (4) preserving and reminiscing heritage values. The novelty of our results resides in the specific and common points of each resident's pre-disaster experiences of living in a historic neighborhood and how it shapes their expectations, needs, and values towards post-disaster permanent homes as similarly investigated in one previous research [76]. Additionally, discussions with design-oriented actors resulted in potentially beneficial ideas about our case study area's rebuilding efforts. Following these outcomes, we further discuss practical implications for the design of post-disaster permanent housing in Antakya and how including more design-oriented actors might contribute to these rebuilding efforts.

6.1. Implications for design of post-disaster permanent housing

Prior studies mainly focused on understanding residents' experiences living in post-earthquake permanent housing in already-built cases [16,21,23,25,30]. Such efforts are valuable in delivering insights for an evidence-based design approach [86]; however, they remain scarce for the planning phase of the rebuilding process through integrating location-specific residents' needs and expectations. In line with this, Rahmayati also suggests reframing the approach "build back better" by considering individual and communal needs and expectations in a location-specific context [9]. Therefore, understanding residents' expectations prior to the design process of post-disaster permanent housing projects is essential for user-centric recovery and long-term satisfaction of the residents.

Designing for togetherness: For instance, our findings indicate that residents of Antakya expect their future homes to promote togetherness. The notion of togetherness is mainly explained through their pre-disaster experiences with other members of their communities within their neighborhoods, and homes. As our results also confirmed, the significance of community in the post-disaster era has been frequently mentioned in prior studies as an essential component for recovery [32]. It is also highlighted in the previous studies that the cultural values and needs of the residents need to be carefully implemented into the post-disaster permanent homes, such as the existence of a family room [32]. Such spatial considerations rooted in pre-disaster practices will help promote the togetherness of the individuals through post-disaster recovery. Past designed post-disaster permanent housing projects such as the architect, Toyo Ito's Soma City Home-for-All project after Tohoku earthquake in Japan [87] also attempted to promote social interactions among its residents by aiming to strengthen community bonds. Such attempts should be supported by case-specific individual values of residents' expectations in the disaster areas by collecting them before the start of the rebuilding process.

Valuing community efforts and traditional work: Furthermore, residents' expectations towards collective and proactive efforts for the rebuilding process are also highlighted in our results. These expectations highlighted the human agency and control over the rebuilding process of post-disaster homes, as well, over the use of domestic technologies within these newly built homes. These findings indicate a tendency of residents for participatory design efforts in the rebuilding process. Previous studies indicated that participatory design approaches in user-centered design positively impacted the long-term outcomes after disasters (e.g., residents' higher degree of satisfaction with the built environment) [88]. As Barenstein suggested, residents after a disaster are not passive recipients of external agencies and have a solid capacity to appropriate their homes to meet their cultural- and livelihood-specific needs [89]. Another study also described that user participation in up-front decision-making results in a positive recovery experience for disaster-affected individuals [31]. Aligned with these, examples of the participatory rebuilding approach in the post-disaster housing context, such as the famous architect Yasmeen Lari's efforts in Pakistan [90], also provide valuable insights into how community ownership of participatory actions contributes to this process.

Preserving and reminiscing heritage values: The other significant finding from our interview sessions with residents was their expectation for preserving and reminiscing heritage values (both tangible and intangible) with the support of technologically enhanced spaces. As previously mentioned, Antakya is a region that has distinct historical value [46,47], and a devastating disaster like an

earthquake caused severe destruction of the historic built environment [63]. Residents were also concerned about losing the intangible heritage practices after the disaster. The prior study explored how heritage conservation and recreation could benefit the resilience agenda, providing affected societies with a sense of localness and continuity [91]. Technology promotes successful outcomes for approaching heritage management in the post-disaster recovery process [92]. It is also underlined by past studies as the intellectual merits of 3D and VR technologies could be rewarding for preserving and providing new forms of access to cultural heritage values [93]. Nofal et al. created the 'phygital heritage' by integrating digital technologies into physical reality to communicate heritage values and qualities [94]. As also appointed in the FC2, new interaction modalities (such as auditory and tactile) with innovative technologies could enable cultural heritage values for preservation and conveyance [95]. These attempts could deliver innovative spatial qualities and designs of domestic spaces for post-disaster housing that resemble heritage values and hold fruitful potential for heritage management throughout the rebuilding process of historic areas after disasters.

Including productional activities: Additionally, the residents we interviewed mentioned their expectations for future homes to support some productional activities (e.g., indoor cultivation) that they can perform at home. These expectations mainly rooted in residents' pre-earthquake experiences of productional activities at home. This is also considered highly important for the livelihood of residents in the post-earthquake times. As prior research also suggests, in post-disaster permanent housing, economic recovery is as equally crucial for residents' satisfaction as architectural design of the homes [29]. Fajarwati also shows the importance of that women in post-disaster areas joined the workforce by doing some productional activities [96]. Another study identifies that the lack of households' economic recovery plan after disasters causes exacerbates the inequality in the area [96]. Hence, considering the economic recovery and the households' livelihood in the post-disaster era, these permanent homes should consider the spatial adaptability and efficiency towards enabling productional activities and workforce from home.

6.2. Inclusion of multi-disciplinary designers' perspectives into the process

Moreover, our research indicated that the inclusion of more design-oriented actors into the rebuilding efforts helped generate more diverse ideas for the post-earthquake permanent housing context. To bridge the gap between the role of design and disaster resilience, Charlesworth [81] identifies that integrated systems analysis thinking can provide an innovative perspective for comprehending the complexities of disaster recovery, as well as a conceptual bridge to novel ways of building socio-economic and physical resilience in disaster-impacted communities. The role of interior design discipline is also stated to be crucial in designing post-disaster homes [97]. Another research also suggests that interdisciplinary and transdisciplinary decision-making is essential for successful outcomes of post-disaster homes because such dichotomies help develop novel methods and tools [98]. *Urgency*, as also acknowledged by our participants in the focus group sessions, is a priority in the aftermath of a disaster. However, well-designed systems-thinking, organizations, and long-term road maps should be encouraged and supported by governments both cost-wise and timewise [99]. In alignment with these, our results from the FC sessions clearly showed that many aspects are rooted in the residents' expectations for post-disaster homes that design-oriented actors could execute through an ideation process. In light of FC2, we conducted the session with interaction designers and obtained diverse perspectives on the rebuilding efforts for post-disaster homes of Antakya. Several other studies also highlight the positive impact of the interaction design perspective on the disaster response process [100]. Especially, interaction designers who work in the built environment hold great potential for targeting the societal goal of supporting environmental sustainability and human resilience in the face of disaster recovery and resilience efforts [101]. Hence, the inclusion of interaction designers and more design-oriented actors into the process will positively contribute to the design process for post-disaster permanent housing.

6.3. Reflections from the user-centric approach for disaster resilience

Another important takeaway from this research is the reflections of our user-centered process on the rebuilding effort of Antakya (see Fig. 6). Our process of investigating the expectations of earthquake-impacted residents towards designing their post-earthquake permanent homes has positively shown promising insights that could be implemented rapidly in the design processes. However, in the aftermath of disasters, such as the 6th of February Kahramanmaraş earthquake events, the rebuilding processes suffer from various pressures of time constraints, corrupted institutional practices, and lack of availability of building materials and builders [102]. We, therefore, strongly advocate for this user-centric approach to be initiated prior to disasters, especially in locations that are at high risk. Since finding common ground for all the stakeholders involved in this process could be difficult, we propose the iterative nature of design discipline [103] could support more user-centric considerations for the rebuilding efforts. Therefore, designing post-disaster permanent homes is not a linear process that starts after the occurrence of a disaster, but it is rather a continuous and iterative process to increase resilience for such destructive events from the perspective of all the stakeholders involved.



Fig. 6. Implementation of user centered thinking approach for disaster resilience.

7. Conclusion

Understanding residents' expectations, needs, and values for designing post-disaster permanent housing is crucial for enhancing individuals' resilience and recovery. This study conducted in-depth semi-structured interviews with ten early adopter disaster-affected residents in Antakya. It revealed five themes about their expectations of post-earthquake permanent homes. Furthermore, we examined these themes in two focus group sessions with five architects and five multi-disciplinary interaction design researchers. Our results are framed by residents' existing values and pre-disaster experiences of living in a historic location, their relationship with domestic technologies, and how it shapes their expectations from future homes.

Our two-step qualitative inquiry resulted in four implications for the design of post-disaster permanent housing in Antakya: (1) designing for togetherness, (2) valuing community efforts and traditional work, (3) including productional activities, and lastly, (4) preserving and reminiscing heritage values. These expectations of residents, together with the multi-disciplinary designers' discussions toward designing post-disaster permanent housing in Antakya, show us that these four implications are inseparable from the recovery process. Moreover, these implications indicate forthcoming architectural transformations in homes, including the emergence of novel heritage and indoor production spaces equipped with innovative digital, physical, and mixed reality technologies within domestic environments. Also, these changes may promote new home design concepts, like social gathering areas, fostering resident togetherness through personalized or shared technologies. Notably, the findings do not suggest any removal of existing architectural spaces, such as kitchens, or alterations in spatial size or layout within these implications. We contribute these significant points through this research; by delving into the user perspectives and incorporating them into the architectural design of post-earthquake housing, our findings advocate for the development of homes that focus on not only providing shelter and safety but also enhance the overall quality of life for the residents of Antakya. These implications we revealed in this study could further support enhancing the disaster-affected individuals' everyday comfort and interaction within their homes by providing them an opportunity for a more positive post-disaster recovery experience. Consequently, this research initiates an important effort for decision-makers, designers, and the technology industry to develop post-disaster permanent housing projects and integrated technologies that are more user-centered.

We further note that this study is from a very specified user group (early adopters of domestic technologies) and shows case-specific results for design implications. Even though, the results of this study represent a unique case of individuals with a limited scope and a convenience sampling, it still provides rich and insightful directions for our case study location. Also, we highlight that this research can provide an exemplary case for extending these user groups to reveal further insights into residents' expectations towards designing post-disaster permanent homes both in Antakya or in other locations. In addition, the whole process adopted through this research could form a basis for future studies of other historic locations affected by disastrous events (such as earthquakes) and/or that face end-of-service-life or obsolescence issues triggered by the residents' technological, functional, and social demands from their homes. Even before a disaster, investigating residents' expectations, needs, and values from other historic locations may help support disaster resilience through long-term planning. Another important point to acknowledge is that the focus group sessions were conducted in both physical and online settings due to the designers' participation conditions. However, to overcome a potential impact on the overall outcomes, we carefully considered replicating the protocol as possible. This also poses an important future direction to deeper considerations of the conditions for designers' inclusion in the process of rebuilding. Finally, extending the focus group sessions could be a beneficial contribution to identifying how different disciplines of design-oriented actors provide novel perspectives to the rebuilding process of the post-disaster permanent homes in Antakya and other locations worldwide.

CRedit authorship contribution statement

Berk Göksenin Tan: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing. **Oğuzhan Özcan:** Supervision, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijdrr.2024.104873>.

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