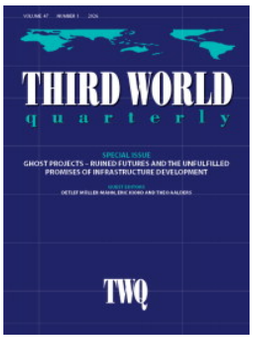

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Resilience by design: emergency architecture, testing and the ecology of aid (1970–1980)

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ABSTRACT

Since the late 2000s, the humanitarian sector has witnessed what scholars have described as an 'innovation turn' in response to what humanitarian innovators conceive as the field's inefficient, backwards-looking and top-down inner workings. In this context, aid actors have increasingly embraced design methodologies in pursuing creative, participatory and human-centred responses to humanitarian crises. However, this turn overshadows a longer history of intersections between design and humanitarian governance. This article contributes to filling this gap by tracing how design and innovation met in the field of post-disaster shelters in the 1970s. Echoing today's 'innovation turn', the period witnessed widespread efforts to innovate cross-border disaster relief interventions amongst international aid actors. Examining the development, implementation and aftermath of the A-frame shelter, a post-disaster housing solution developed by Carnegie Mellon University and the consultancy Intertect between 1974 and 1977, the article argues that the project announced a new understanding of the role of design responses to disasters, that of a practice that through participative and iterative problem-solving methods aimed to produce mobile protocols capable of rendering local populations more resilient to environmental catastrophes. The article thereby exposes and critically examines the longstanding intersections between humanitarian aid, design and early resilience thinking.

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Introduction

Since the late 2000s, the humanitarian field has witnessed what scholars have described as being in the grips of an 'innovation turn' (Scott-Smith 2016). Faced with the necessity to reform its inner workings, innovation has been advocated as 'a means of finding and scaling solutions to problems, in the form of products, processes or wider business models', often pursued in tandem with the private sector (Betts and Bloom 2014, 14). In an environment that values decentralisation, flexibility and self-administration, the turn to innovation also encapsulates the rise of resilience thinking in aid. Developing out of the widespread belief in the increasingly complex nature of humanitarian crises, heightened securitisation concerns and the spread of neoliberal forms of governance (Duffield 2012), this paradigm reflects

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a new form of governing crises, which rests on the notion that 'people, communities and societies (can) have the capacity to adapt to or spring back from tragic life events and disasters' (Hilhorst 2018, 5), thereby blurring the strict division between crisis and normality that pervades classic humanitarianism (Hilhorst 2018). Reflecting the broader rise of forms of governance 'from below' (Chandler 2014), resilience humanitarianism favours non-state and private actors over the state and perceives citizens as responsible for ensuring their own well-being and survival, partly by presenting them as economic agents (Duffield 2012). In this context, design has emerged as a key tool for rendering individuals more resilient to conditions of uncertainty. On the one hand, design has come to be regularly called upon to develop innovative technologies and services that consider local conditions and social relations and which seek to maintain or replace disrupted local activities temporarily (Fladvad Nielsen 2020), including by assisting individuals in entering markets (Johnson 2011; Redfield 2012). On the other hand, the influence of design is also evident in the spread of a specific approach to creative problem-solving, which, drawing upon the precepts of design thinking, often involves a step-by-step process that ranges from problem definition to the development of potential solutions, iterative testing and local implementation. Emphasising the value of prototyping and tinkering processes, these approaches assist designers and aid practitioners in developing designs able to adapt to complex and changing conditions on the ground, including by involving end-users at the conception, testing and implementation stages (Betts and Bloom 2014). Proponents of these approaches celebrate risk as an opportunity for enterprise and reinvention. As such, innovation hubs have taken on the moniker of 'innovation labs', and crisis conditions have been described as laboratories where innovation methodologies can be further developed (Bessant, Rush, and Trifilova 2015). Scholars have nevertheless uncovered how the real-life testing of humanitarian technology is often conducted on populations rendered vulnerable by humanitarian crises and who, through their inclusion in humanitarian trials, endure secondary effects and life-threatening risks (Jacobsen 2010). More broadly, humanitarian innovation has been condemned for helping generate the systems and structures that govern global precarity, which, by reproducing 'designerly' discourses of adaptation and self-administration, preclude any possibility for political change (Duffield 2019). As such, design as an epistemology and practice has become deeply entwined in the spread of resilience humanitarianism, with all the fraught politics this entails.

Nevertheless, while scholars have explored the more recent links between resilience and design in humanitarian aid (Duffield 2012, 2019; Lee 2016), their longstanding intersection remains overlooked to this day. This is surprising as scholars have uncovered the shared genealogies of resilience and design in the twentieth century (Halpern and Mitchell 2022; Grove 2018). In particular, Kevin Grove has mapped the close links between the modern design roots of cybernetic thinking with post-World War II theories of complexity, which contributed to a distinct style of thought about social and environmental change that sought to engage with 'complex phenomena from a position of necessarily partial and limited knowledge' through integrative, adaptive solutions (2018, 16). Similarly, Orit Halpern has uncovered how Cold War nuclear attack calculations and US efforts to shape and oversee the future of populations in decolonising territories, which included design experiments fuelled by aspirations to reinvent human life and habitat as a Terran-scale experiment, announced the recent spread of resilience thinking (2019). Building on this scholarship and examining historical intersections between design and disaster responses in the 1970s, this article argues

that the recent spread of design methodologies and practices in humanitarian aid should be seen as the newest iteration of an influential episteme that emerged during this period. By then, governmental and international non-governmental actors turned to architects to develop housing solutions that catered to what they envisioned as the unpredictability and, most importantly, the inevitability of 'natural' disasters (Kunkel 2020; Messell 2022) through adaptive designs that could be built and modified by disaster-affected populations within a longer developmental horizon.

The article explores this shift by considering the development, implementation and aftermath of the US-based 'A-frame' shelter project between 1974 and 1980. By then, humanitarian architecture specialised within a consolidating international disaster system (Iyer Siddiqi 2017), and leading agencies set out to pursue 'the elusive quest for a "universal shelter"' (Davis and Alexander 2015, 228; see also Herscher 2019; Storh 2006). In response to the perceived failures and adverse outcomes of such approaches, the disaster community, however, also witnessed attempts to develop housing methodologies that could adapt to various social, cultural, geographic and climatic conditions on the ground. The A-frame project, led by a multidisciplinary team of researchers and practitioners from Carnegie Mellon University (CMU) and the private consultancy firm Intertect, developed from these shared concerns. It rapidly received funding from the United States Agency for International Development (USAID) and was closely followed by large relief organisations such as OXFAM and Care, who, in the case of success, aimed to implement the design on a mass scale. After being field-tested in Guatemala and trialled in Bihari refugee camps and a village around Dhaka (then known as Dacca), Bangladesh, the project team shifted its emphasis to pre-disaster housing mitigation responses in Peru.

Mapping the network of expertise and experimentation that coalesced around these experiments, the paper argues that they materialised a new understanding of disasters, human agency, and design. Here, disasters were not unmanageable one-time calamities (Hewitt 1983), but an occasion to introduce long-term housing solutions through systems thinking approaches that brought together iterative problem-solving methods, tropes of 'tropicality' and grassroots self-help rationalities. While the projects developed out of broader attempts to counter disaster responses that oversaw local imperatives and capacities and sought to address the root causes of disasters, as evident in the rise of the vulnerability paradigm during this period (Bankoff 2019; Revet 2020), they also reflected a shift away from state-led modernist technologies of protection to the embrace of local, flexible adjustments aimed at facilitating the self-management, preparedness and long-term resilience of disaster-affected communities. As this paper argues, some of the conditions and norms that shaped these experiments still shape our understanding of design in humanitarian aid today, when the state of crisis has become the new normality, and innovation predominantly rests on decentralised, user-led responses to complex, protracted disasters. At a time when the innovation turn has been condemned for being inherently ahistorical and apolitical (Davey and Scriven 2015), bringing forth these genealogies can lay the ground for a better understanding of the limitations and forces that have shaped the relations between design and humanitarian aid historically and, more recently, to reflect on future policies and practices.

The article is structured as follows. First, it offers a historical examination of architecture's role in disaster responses in the 1970s and a series of disasters that contributed to transforming the field at the turn of the decade, laying the ground for increased collaboration. From there, the article examines the inception, development and implementation of the

CMU/Intertect housing experiments within a broader interest in mitigation approaches to so-called 'natural' disasters,[1] self-help and systems thinking methodologies. The conclusion subsequently ties these approaches to contemporary resilience-infused housing solutions and reflects on how the histories examined can inform a critical examination of established practices. The paper draws on evidence from the Carnegie Mellon University Archives and the Frederick C. Cuny/INTERTECT Collection, which provide in-depth accounts of the experiments' contexts, influences and outcomes from the CMU/Intertect team's perspective.

Crisis and humanitarian architecture

In many societies, disasters have been widely seen as agents of change and, to some, even opportunities for political, economic and moral progress. Scholars have shed light on how governmental and non-governmental actors have envisioned disasters as opportunities to introduce or advance political, economic and social aims and practices in societies struck by catastrophes (Healey 2011; Irwin 2018a, 43; Rozario 2019). Juxtaposed with these histories, disasters have constituted a central preoccupation in the modern project, where such events have been regarded as opportunities to experiment with new conceptions of society (Watson 2019). Architecture has played a central part in these undertakings, which conversely contributed to the emergence of architectural modernism, partly as a result of the acute need for low-cost and mass housing after the First World War (Storh 2006). From then on, a *tabula rasa* conception of post-disaster sites prevailed among various architects and planners, who set out to experiment with comprehensively planned Modernist and, later on, self-help housing methods (Gyger 2019; Storh 2006). By the 1970s, such initiatives had contributed to the increased institutionalisation of humanitarian architecture within an expanding humanitarian system (Iyer Siddiqi 2017), whose members increasingly sought to respond to hazards and conditions of uncertainty on a world scale.

By then, movements for decolonisation had resulted in a vacuum quickly occupied by states and relief organisations, which contributed to the formation of a globally oriented humanitarian infrastructure. Spurred by discourses of humanity and the international community, powerful states harnessed humanitarianism as a tool of soft power, while international and non-governmental organisations (NGOs) set out to expand their zones of intervention (Barnett 2011). Moreover, the late 1960s and early 1970s witnessed a series of devastating disasters, from the Biafra Civil War between 1967 and 1970 to the Peruvian earthquake of May 1970 and the tropical cyclone Bhola in East Pakistan in November 1970. These events highlighted the shortcomings of cross-border emergency assistance, which included a lack of international coordination to the dispatching of unadapted and at times harmful items. As a result, an international humanitarian knowledge community was consolidated. Governments and intergovernmental agencies increasingly established new institutions and departments dedicated to humanitarian response, and NGOs set out to enhance their effectiveness by expanding their networks (Davey, Borton, and Foley 2013). Efforts to increase the efficiency of aid responses also led to the establishment of various multidisciplinary disaster research groups, through which past relief operations were scrutinised, and future forms of responses were devised. While architects and post-disaster housing experts prevailed in some of these groups, the period also witnessed a growing number of universities or research units involved in projects on emergency shelters (Davis 1978). The A-frame

shelter experiment and follow-up project emerged from these overlapping networks and concerns.

A shelter for 'tropical climates': engineers and architects join arms

The A-frame project was sparked by a meeting between the engineer and planner Fred Cuny with the Assistant Professor in Civil Engineering Charles H. Goodspeed and the Assistant Professor of Architecture Volker Hartkopf, both affiliated with Carnegie Mellon University. All three brought together the fields of architecture and engineering in the face of disasters and would oversee the development of the A-frame shelter, which, from the onset, was conceived to become a standard form of refugee housing in indistinct 'tropical climates' in the aftermath of so-called 'natural' and 'man-made' disasters (Hanna n.d.). Fred Cuny had become a key figure in engineering and architectural solutions to humanitarian crises from the 1970s onwards (see Figure 1). Having studied civil engineering at Texas A&M University and urban planning at the University of Houston, Cuny set out to find more meaningful applications of his skills, and in 1969, he was involved in flying relief supplies into Biafra. Upon his return, Cuny created INTERTECT Relief and Reconstruction Corporation, later called Intertect (a loose acronym for International Architects). Based in Dallas, the consultancy employed a multidisciplinary group of practitioners and researchers and aimed at providing technical skills for relief organisations and disaster victims (Inderman 1976; Martin 1976). In addition to Cuny's high visibility in humanitarian circles, his much-publicised guidelines would contribute to shaping the post-disaster shelter and housing sectors (Davey, Borton, and Foley 2013).

Volker Hartkopf and Charles Goodspeed, on the other hand, taught architecture and engineering, respectively, at CMU. Both men were involved in the Advanced Building Studies (ABS) graduate programme, within which the A-frame shelter project was conducted. Initiated by Hartkopf (who would subsequently direct it), the programme was established by the Departments of Architecture and Civil Engineering and the School of Urban and Public Affairs in 1975 under a grant from the National Science Foundation (NSF) (Cyert 1975). Aiming to develop problem-solving approaches that transcended the capabilities of a single discipline to solve complex problems, the programme catered to practising architects, engineers, planners and construction representatives who were taught planning, design, construction and project operation for the building industry (Cyert 1975). In addition to the NSF grant, contracts in three major project areas were secured by Volker and Goodspeed to 'realise the goal of teaching design through project and research experience', of which two were achieved with USAID, namely the 'Feasibility Test and Approach and Prototype for Ultra Low-Cost Housing Bangladesh (1975–1977)', and pre-disaster planning for earthquake-prone areas in Peru between 1976 and 1980 (Hartkopf n.d.). In response to what many voluntary agencies witnessed during the Bangladesh Civil War and reconstruction period, Intertect had, since 1972, explored the possibility of providing wind-resistant designs for refugee camp shelters utilising indigenous building materials such as bamboo and palm leaves (Hartkopf 1980). In search of architectural expertise, Cuny contacted CMU for information on emergency housing, leading to their collaboration (Butler 1977). Preliminary designs were developed, and material tests were conducted in the CMU Laboratory, following which a full-scale model was built alongside study models. During the fall of 1974, a team of CMU students and faculty supported by Intertect went to the jungle of Peten, Guatemala, to conduct a field test to save costs (Hartkopf n.d.), where the team tested the 'comprehension levels of illiterate people in rural areas (how they read models and

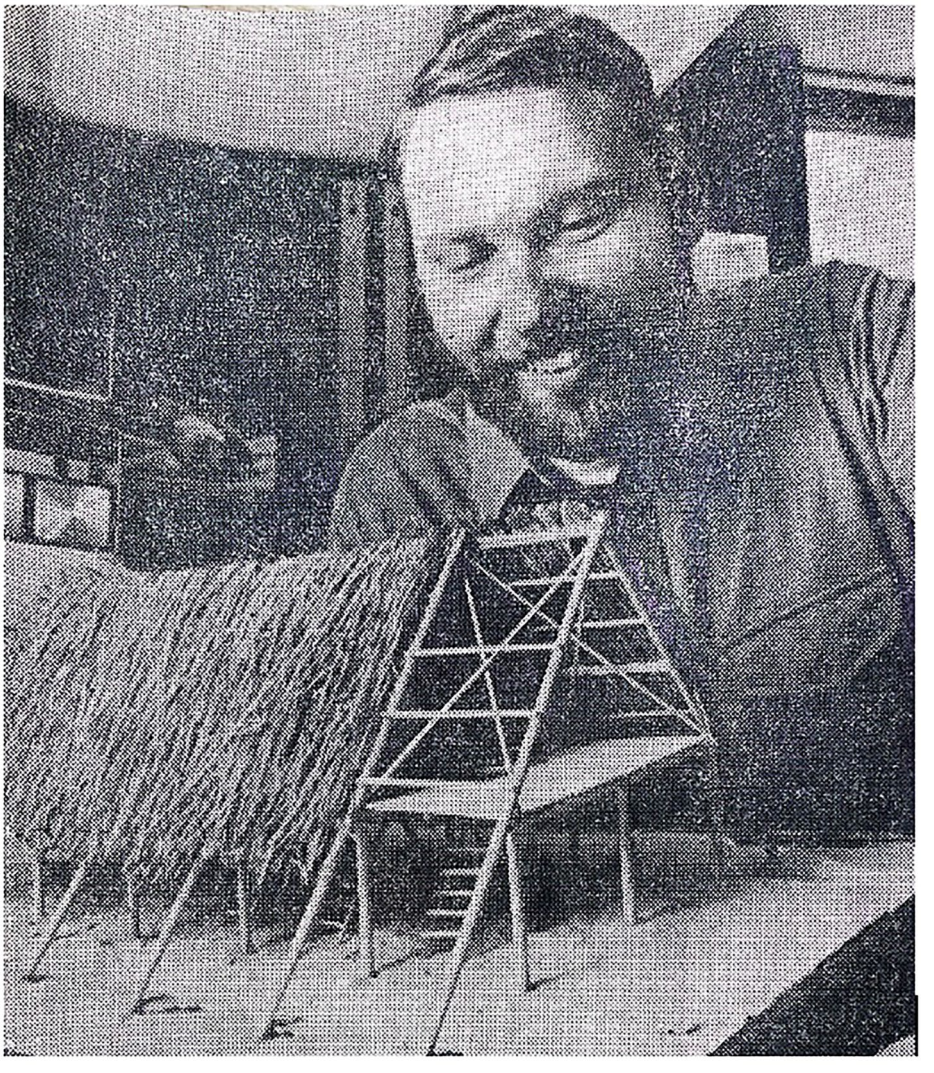

Figure 1. Fred Cuny with the A-frame model.
Source: Robert Inderman, 'Texas Firm Specializes in $10 Refugee Dwelling', *Houston Chronicle* (Sunday, 30 May 1976). UPI Telephoto.

drawings)' and sought to learn how roofs could be covered and joints could be achieved with 'native materials' (Hartkopf n.d.). As a result, USAID became convinced of the validity of the approach and agreed to fund a 'feasibility study test' in flood-prone refugee camps in Bangladesh, initiated in the spring of 1975 (Hartkopf n.d.). As seen next, once the project received funding from USAID, it became symptomatic of the coalescence of design, early resilience thinking and humanitarian relief within broader Cold War and development contexts.

Project development: systems thinking, testing rationalities and self-help

USAID's financing of the CMU/Intertect A-frame project occurred when the US government increased its involvement in international disaster relief and awarded growing importance

to technological and scientific solutions in response to environmental hazards. The United States had since 1900 expanded its participation in international disaster relief. This endeavour aimed at enhancing the country's national image beyond its borders, protecting its trade and assets abroad by bringing order and stability to disaster-stricken regions and thereby restoring economic conditions, and pursuing the nation's 'moral obligation to improve the world' (Irwin 2018b, unpaginated). These imperatives remained central to American involvement in disaster relief by the 1960s and 1970s, when the challenges of the global Cold War, decolonisation and international development reinforced the belief in the political and economic significance of cross-border disaster relief among US policymakers. By then, the United States had become one of the main funders of disaster relief activities worldwide, with US policymakers providing 'millions of dollars' worth of cash, food, military support, and other aid to dozens of disaster-stricken countries every year', as historian Julia Irwin notes (2018b, unpaginated). In addition, by the late 1960s, the AID Office for Foreign Disaster Assistance (AID/OFDA), created in 1964 to coordinate and improve US governmental disaster response, awarded further importance to disaster prevention, preparedness and prediction training programmes in disaster-prone nations (National Academy of Sciences 1978). Such efforts were allied with the search for effective technological and scientific solutions to disasters to be implemented in relief programmes abroad (National Academy of Sciences 1978, 13).

While technocratic, top-down solutions were the backbone of global disaster policies in the 1960s (Kunkel 2020), the problems and limitations of techno-scientific responses to disasters became evident by the end of the decade. On the one hand, as discussed above, the material aid sent predominantly failed to answer local needs and socio-cultural specificities. On the other hand, aid actors increasingly conceived disasters as resulting from longstanding and complex socio-ecological interactions, through which distinctions between development and disaster relief, as well as between pre-disaster and post-disaster measures, became progressively questioned (Kent 1983). The perceived globalisation of risk, declining role of the state and broader 'de-legitimisation of pure scientific knowledge' moreover oriented disaster management towards more integrated responses that drew upon various stakeholders, practices and forms of knowledge, while increasingly taking into account the political, economic and social factors of disaster risk (de Milliano et al. 2015, 18–19). These concerns were felt by the US government, as reflected in its financing of research groups exploring how science and technology could enhance pre- and post-disaster responses, something which their members equated with decision-making in 'conditions of uncertainty' due to the meagre and at times non-existent available information following a disaster (National Academy of Sciences 1978, 1). This was the case of the Committee on International Disaster Assistance (CIDA), created in 1976 by the OFDA. Presided over by the founder of the US Disaster Research Centre, sociologist Russell Dynes, the committee brought together 18 experts from the fields of disaster research, political science, epidemiology, architecture and design (Messell 2023; Revet 2020).

CIDA played an important role in establishing the view that disasters needed to be managed within a timeframe ranging from prevention to post-disaster rehabilitation and through interdisciplinary approaches that recognised the interconnectedness of disaster and development (Lechat 2013, 6). Much of this was due to the active involvement of members who contributed to relief approaches that announced the rise of resilience thinking in disaster responses. The group included first-generation disaster researchers whose work had examined social behaviour in disaster situations within broader Cold War US

civil defence efforts, such as Charles Fritz (Knowles 2013, 327). However, it also housed individuals whose writings contributed to the rising popularity of mitigation approaches in the 1970s, as was the case with the architect and planner Frederick Krimgold. Mitigation procedures involved measures that sought to minimise destruction and the disruptive effects of hazards, and which could be integrated with broader development activities. Examples included planting crops less affected by disasters, developing diversified economies so that losses in one sector could be absorbed by another, and strengthening buildings to make them earthquake-resistant (Cuny 1983, 205). These approaches echoed the writings of one of the leading American figures of disaster studies, the geographer Gilbert F. White, who, amongst other social research scholars, examined ways of adaptation or adjustment to disasters 'from an "ecological" perspective'. Allied with reports of the aforementioned failures of international responses to disasters, White investigated the adjustments individuals made to reduce damages occasioned by disasters while recognising that hazards resulted 'from interactions between social, biological and physical systems in which people exercise choice among a large number of options subject to social constraints' (White 1978, 229). Thus, for him, 'a crucial aspect of any long-term accommodation to the human environment' had to be 'the skilful, sensitive use of a wide range of adjustments' (White 1974, 3), which included combined strategies such as land management, engineering solutions, warning systems and the halting of development projects that increased the vulnerability of local communities (Kunkel 2020, 138). The work conducted by committee members aligned with the prevailing belief amongst disaster relief officials that pre-disaster measures would assist societies in preserving the continuity of social life in the face of disasters (National Academy of Sciences 1978, 3). In this context, carefully calibrated 'adjustments' ranging from top-down techno-scientific responses to user-led interventions were conceived as helping minimise societal disruption. As seen next, the A-frame shelter experiment can be traced to these shifts while reflecting how design interventions helped implement new responses to disasters on the ground.

Responding to complex crises: designing a shelter for 'Third World situations'

Cuny was involved in CIDA's activities throughout the 1970s and regularly crossed paths with the committee's researchers and practitioners.[2] From 1975 onwards, he closely collaborated with Krimgold and the architect Ian Davis, who, beyond being involved in CIDA, would, together with him and other consultants, be involved in the first international study on the subject of emergency shelter and the subsequent drafting of international guidelines for the United Nations Disaster Relief Organization (UNDRO), published in 1982 (Davis, Thompson, and Krimgold 2015, 5–6). Cuny was also in close contact with Gilbert White by the 1970s and, similarly to Krimgold, became a strong advocate for mitigation approaches while pioneering the necessity to recognise the disaster and development continuum (Cuny 1978, 1983). Conversely, the CMU team closely followed CIDA's activities and came into contact with some of Cuny's close collaborators (Carnegie-Mellon/Intertect Emergency Shelter Team 1978, 10).

However, while the A-frame project was connected to these networks and methodologies, it also drew from the research procedures that coalesced at CMU at the time and Cuny's approaches, reflecting close links between design, systems thinking and disaster responses during this period. Interdisciplinary procedures and systems-theory-infused approaches to

housing and urban planning had been longstanding by then (Aggregate Architectural History Collaborative 2022; Dutta 2013), and CMU witnessed and contributed to advancing these methods, which in turn shaped the A-frame shelter. By the time the project was initiated, Carnegie Mellon had set out to increase the number of its interdisciplinary courses, a process which had led the engineering curriculum to be grounded in a college-wide sequence of three courses, and which favoured problem-oriented approaches while giving more weight to design and creativity (Cyert 1974, 6). The emphasis on problem-solving techniques derived from Herbert Simon's influential position at the university, where he contributed to the formation of several departments and schools. Having studied political science at the University of Chicago, where Simon discovered an 'interdisciplinary research culture founded on objectivity and faith in scientific methods' (Huppatz 2015, 30), the political scientist and economist believed in the benefits of interdisciplinary research pursued in a problem-centred way, a process that involved a focus on solving problems with 'tangible, testable, real-world implications', through which theory could be tested in real life, which could enhance problem-solving capacities by advancing theory (Crowther-Heyck 2005, 146–147). Simon's concept of 'bounded rationality', along with that of other second-generation cybernetic thinkers, had also guided Gilbert White's work on risk perception and decision-making in the face of natural hazards (Grove 2018, 158). Some of these methods shaped CMU's educational approaches, which, as noted above, remained often tied to interdisciplinary research and problem-solving rationalities.

In the case of the A-frame shelter, this step-by-step process became allied with an iterative approach to the design, which sought to respond to unpredictable and complex conditions on the ground. As noted above, the ABS graduate programme sought to advance interdisciplinary work in the face of complex problems. In the case of projects like the A-frame shelter, the latter aimed to address the complex issues of building and social change in 'Third World situations', where multidisciplinary teams of experts would be able to devise context-sensitive solutions to 'improve the socio-economic conditions of society as a whole' (Hartkopf n.d., 3). The development of the A-frame shelter, therefore, relied on a systems approach to housing policy which considered the broader social and political structures of the problem. Moreover, in line with Simon's merging of real-life cases and theory, Volker and Hartkopf valued applied research projects that involved students in the problem formulation, design, construction, occupancy and evaluation stages, and the formulation of guidelines for future action. Crucially, Volker and Hartkopf considered the evaluation phase particularly important, as it allowed practitioners to 'keep the design responsive to user needs, and to test the relative successes or failures of the project itself' (Hartkopf n.d., 3).

Intertect similarly set out to merge research and action in disaster responses. As Cuny noted during this period, 'A lot of people do research in this field [disaster relief], but no one except us combines research with construction capabilities. We do the research, produce the designs and actually work in the field' (Inderman 1976). By 1976, the consultancy employed a full-time engineer, an architect, an expert in development research and a draftsman alongside Cuny himself. In addition, architects and engineers were involved in Intertect's research advisory committee, individuals sent to disaster sites to investigate and assist populations when a disaster struck (Inderman 1976; Martin 1976). Cuny's approach was indebted to action research, a practice which by then was widely used in the collection of 'field-based evidence on disaster response and its relation to development' and which sought to involve participants in the process, thus overturning 'the role of architect as auteur and […] the

architect's training to intervene formally', as Anooradha Iyer Siddiqi writes (2017, 370). The search for information exchange and context-sensitive disaster responses was also reflected in the A-frame team's attempts to develop an information-sharing system that ranged from an Information Exchange Centre and an Information Bank aimed at preserving and circulating on-site information between voluntary agencies, relief research centres, and relief workers (Goodspeed 1977b; Goodspeed et al. 1975). Through the latter, its members once again addressed the issue of disaster housing as an open-ended process that needed to address various local specificities and constraints through continuous feedback loops.

In accordance with the iterative nature of its design process, the shelter itself was also developed as an adaptive housing typology that could be implemented in sites characterised by different social and environmental conditions, and which could evolve from relief housing into long-term settlements. To begin with, the A-frame shelter project team set out to respond to refugee crises in different, but what they understood as equivalent, 'tropical' settings characterised by similar cultural, climatic and socio-political attributes. As stated above, Cuny became a close collaborator of the architect Ian Davis, who had close links with some of the leading actors of the Tropical Architecture movement. The latter was based on techno-scientific Modernist principles as applied to non-Western humid zones, which, as Ashika Singh notes, 'inherited from colonialism its racialised categories of non-European cultures and its sedimented configurations of power' (2021, 35). For the CMU/Intertect team, the focus of the project was similarly to provide a shelter methodology which could be made in any 'tropical environment', as the latter often involved climates affected by flooding, strong wind and heat, similar house shapes, and active refugee operations. Nevertheless, the A-frame shelter also relied on local material resources and practices for cultural and economic reasons (see Figure 2). Hence, the structure was conceived so that different materials could be used for its construction, depending on available materials in specific sites and users'

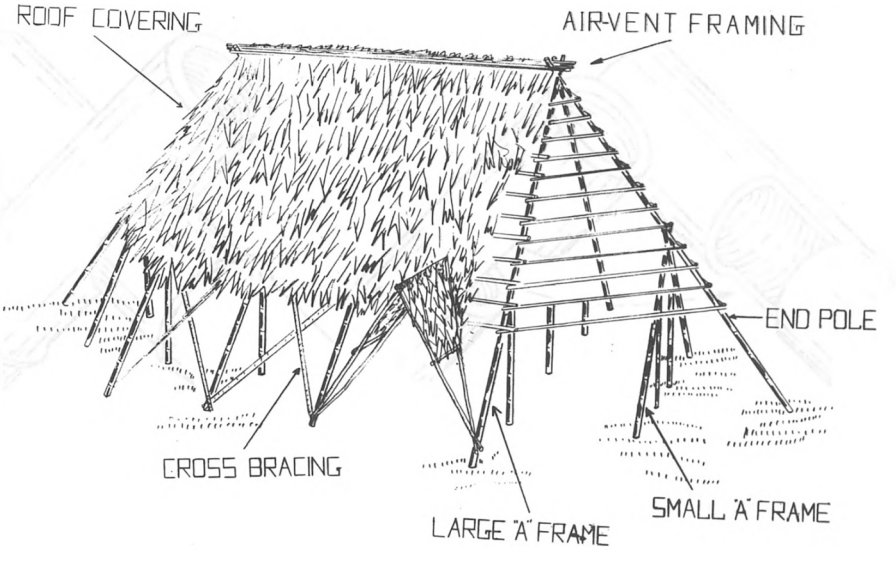

Figure 2. Diagram of the A-frame shelter without the floor using bamboo for the structural members and thatching of bamboo or mat for the roof covering.
Source: Goodspeed et al. (1975, 39). The Frederick C. Cuny/INTERTECT Collection.

preferences (Goodspeed et al. 1975). The shelter was also developed to adapt to diverse environmental hazards by incorporating optional features such as a higher floor providing a temporary escape from flooding (Goodspeed et al. 1975). The structure as such was regarded as being able to adapt and evolve in response to various changing environments and practices, an approach which nevertheless remained marked by tropes of 'tropicality', aimed to secure the widespread export of the methodology.

The A-frame shelter was also conceived to be built, maintained and modified by end-users to better answer housing needs in locations characterised by low socio-economic resources, through which the responsibility for survival was in large parts placed on the shoulders of disaster-affected populations and low-income, rural communities. To meet this requirement, the team strove to develop a structure that was easy to understand and simple to build and which required tools with which 'rural people in the developing countries would be familiar' (Goodspeed et al. 1975, 5). This approach allowed for a form of agency which echoed small-scale basic need approaches, as epitomised in the Intermediate Technology movement and the rise of self-help methods at the time (O'Sullivan 2021), which by then witnessed broader interest in the circles of disaster housing (Cuny and Weesner 1976). This methodology also reflected Cuny's efforts to bring together technical effectiveness and political accountability. As he stated in 1985 concerning Intertect: 'We wanted to design and change the world' (Harrigan 1985, 202). Having witnessed traditional disaster relief during his time in Biafra, which the planner concluded offered only quick fixes, thereby evading structural issues, and involved a massive infusion of unsuitable goods which were often destructive to local economies, he had developed the 'Cuny approach', which set out to improve people's lives by using disasters as catalysts for economic development and social change. In the case of refugee camp designs, this approach was grounded in the concept of 'community', which Cuny believed could be supported and enhanced through technological and planning solutions, thereby enabling 'refugees to recover faster and look after their own welfare sooner' (Iyer Siddiqi 2017, 372). However, the A-frame experiment also reflected changing ideas about housing in this period, most clearly in response to the declining role of states as noted above and in the case of the shelter experiment, local constraints (Goodspeed et al. 1975). Thus, on the one hand, the construction aimed to prevent 'revolution or despair' following disasters and ensure that 'stability' (emotional and behavioural), refugee involvement and administrative imperatives were covered (Stearns n.d., 34; Hartkopf and Goodspeed 1979, 444). Moreover, by focusing on the shelter itself and social change from the perspective of users, as opposed to the camp's broader social and political context, the project oversaw the broader causes of disaster vulnerability and allowed the maintenance of inhabitants in areas affected by hazard risk. This rationality extended to low-income and rural populations across the then-denominated 'developing countries', where the team believed minimal emergency housing, such as the A-frame shelter, would act as an apt low-cost housing solution (Hartkopf and Goodspeed 1979). In this context, disasters allowed for architectural responses that aimed for transformational change, albeit from the perspective of local aid workers and users alone.

The A-frame and transnational circuits of testing

As a result of the project's aim to produce a generic shelter method which could be applied to emergencies in any 'tropical' context, the project team hoped that the evaluation of the

shelter prototypes in Bangladesh was positive; this could lead to mass use of the houses by international relief organisations, with possibilities for the team to receive additional funding to continue refugee housing development 'on a world-wide basis' (Hanna n.d.). The testing of the A-frame shelter was therefore conducted in what the team considered a range of 'tropical' sites, through which the project's feasibility could be evaluated. This process culminated in the shelter's implementation in Bangladesh, where it became part and parcel of broader developmental experiments. As written above, the shelter was first tested in Guatemala, a country which the CMU/Intertect team regarded as having similar climatic conditions to Bangladesh. After the shelter was constructed and tested in Guatemala, the team set out to have another prototype structure wind-tested by the US National Bureau of Standards in the Philippines (Stearns n.d.). The final field test was overseen by a series of voluntary organisations in Bihari refugee camps around Dacca between 1975 and 1977, where the Bangladeshi government funded the construction of the shelters, in addition to USAID's funding towards research and travelling.[3] Two units, financed by American and British voluntary organisations, were also built in Kunda, a village in the Comilla District, where the shelters would be tested as a long-term replacement for structures destroyed in natural disasters, particularly in rural areas (Hartkopf and Goodspeed 1979, 454). The testing of the shelter took place within a broader frenzy for trials and pilot projects in the newly independent nation, where, as Michelle Murphy writes, development experiments were 'tangled in postcolonial national modernisation projects as much as emergent forms of transnational imperialism' (2017, 79). Amongst the Bihari refugee camps, Mirpur had been selected by different relief agencies to develop an 'integrated' and 'planned community' through which agencies and the Bangladeshi government could 'test a variety of physical planning concepts designed to increase community cohesiveness, reduce administrative costs, increase useable space' and test the CMU/Intertect shelter, alongside the determination of its costs (see Figure 3). The A-frame demonstration shelter was, moreover, built close to Oxfam's rehabilitation project within a section of the camp, where it had also installed its newly designed sanitation unit and where a fishpond stocked by UNICEF and a vegetable garden were to be managed by the refugees, alongside other implementations (Goodspeed et al. 1975, 74).

As seen next, the shelters' overall failure to engage with local specificities and requirements, however, highlighted the limits of the team's approach. Its performance was evaluated by the sociologist Vijay Singh from the University of Pittsburgh and, two years later, by Everett Ressler from Intertect (Hartkopf n.d., 1976). In line with its initial approach, the CMU/Intertect team hoped that the shelters had been modified to allow for local participation in the design, a desire which echoed the structure's evolutionary nature. Some shelters had been altered and enhanced; however, as reported by Singh and Ressler, several issues had arisen that prevented the wholesale adoption of the shelter by voluntary organisations and users. As reported by both Bengali and Bihari users, the A-frame shelter structure differed too much from other, more conventional surrounding structures, and a lack of communication had prevailed between the refugees and the CMU/Intertect construction team, which had prevented the former from contributing to the design of the structure. Moreover, leaking had been reported in several of the shelters, and their price was deemed too high by both refugees and the relief organisations in the refugee camps. Most importantly, the shelter's strength and durability were considered too permanent for relief agencies and too temporary for its users due to its restricted space and privacy, reflecting contrasting aspirations on the

Figure 3. Photograph of the Mirpur Housing Project.
Source: Goodspeed et al. (1975, 17). The Frederick C. Cuny/INTERTECT Collection.

ground (Goodspeed, Hartkopf, and Cuny 1977). As a result, the shelters had little effect on local construction approaches and the CMU/Intertect team concluded that it had fundamentally failed to understand the point of view of the disaster victim (Carnegie-Mellon/Intertect Emergency Shelter Team 1978, 8).

Earthquake responses and self-help experiments in Peru

The project's mitigated reception nevertheless led the CMU/Intertect team to develop a shelter methodology, which aimed to move the project further away from designing from afar, at a time when Cuny worked on mitigation approaches that aimed to assist low-income communities across the 'Third World' in making their homes more disaster resistant. The latter occurred within a broader interest in user-led housing modifications for contexts where building codes, standards and zoning controls were non-existent, unenforceable or incapable of providing meaningful tools for local housing or planning authorities (Cuny 1978, n.d.; Kunkel 2020). Reproducing this strategy and answering USAID's invitation to shift the project's emphasis from post-disaster responses to pre-disaster mitigation through the improvement of existing housing in disaster-prone regions (CMU/Intertect n.d.), the CMU/Intertect methodology, as reported upon in 1978, included advice on the importance of pre-disaster housing solutions, in particular the evaluation of building vulnerability and the reinforcement of vulnerable housing with the inhabitants and through educational means (Carnegie-Mellon/Intertect Emergency Shelter Team 1978, 9–10). Aiming to spread this housing process globally, the team set out to find new 'test sites' in Asia and Africa where the methodology could

be trialled and further developed for diffusion. Following a trip funded by UNDRO, which allowed the team to establish connections with representatives of governments, international governmental organisations and NGOs (CMU/Intertect 1977, 6), this methodology was put to the test in earthquake-prone areas in Peru. The project, conducted with the Ministerio de Vivienda y Construccion (Ministry of Housing) and supported by the AID mission in Lima, aimed to develop approaches and technical materials to promote housing changes in 'high-risk, vulnerable areas' along with the development of strategies and materials for post-disaster housing responses in rural, mountainous regions (CMU/Intertect n.d., 282). Following unsuccessful attempts to develop innovative construction materials, the project conducted a field test in the town of Acomayo in central Peru, where the team tested visual training aids showing house-strengthening methods for instructors, builders and self-help builders and the participatory building of housing demonstrations using the latter. These initiatives nevertheless failed to answer local imperatives and conditions and to complete the planned buildings, while generating community expectations that could not be met by the government (CMU/Intertect n.d.).[4] The project was grounded in Cuny's recognition of the need to foster local development by privileging local materials and techniques and the importance of the users' close involvement in the process in future technical housing improvement programmes. However, at a time when the broader harnessing of self-help in Peru frequently validated 'the state's disengagement from housing provision' (Gyger 2013, 15), it also epitomised a form of disaster response that relied on the spread of decentralised low-cost 'adjustments' that relied on local communities' aptitude to improve their capacity to address disaster risks. This project as such once again located the role of architecture in strengthening bottom-up disaster mitigation processes, through which the broader causes of disaster vulnerability, such as land rights, remained in large parts sidestepped. Through its planned diffusion of visual teaching aids and new building practices across earthquake-prone regions, the project epitomised changing cross-border understandings of disaster management for the 'Third World'.

Conclusion

In addition to being funded by USAID and other state actors and being implemented by large humanitarian organisations, the A-frame shelter became a celebrated typology of shelter response. It gained visibility within circuits of information exchange between individuals interested in post-disaster housing issues, received the Prix UNESCO (United Nations Educational, Scientific and Cultural Organization) in 1975 and was promoted as part of USAID's international disaster assistance programme (Cyert 1974; Goodspeed 1977a). On the other hand, the CMU/Intertect collaboration with the Peruvian government reflected broader efforts to develop community-led disaster housing projects, and, along with the A-frame shelter, contributed to the dissemination of architectural expertise in humanitarian circles. By being developed towards the mass implementation of new housing solutions in refugee settings and low-income communities across the 'Third World', these experiments epitomised a new understanding of the role of design in response to disasters as a practice which, through iterative problem-solving methods, could produce mobile protocols capable of increasing the resilience and long-term welfare of disaster-affected populations. As highlighted in this article, this approach emerged from wider efforts to expand disaster housing

responses to include long-term local agency and aspirations when devising shelter methodologies. In the case of the A-frame shelter and Peru projects, these modes of intervention nevertheless also reflected a need for solutions that catered to the limited capacity of states and international aid organisations to implement large-scale disaster solutions due to economic, technical and legal constraints, while answering securitisation and development imperatives. In this context, the turn to self-help frameworks underlined the spread of 'laissez-faire' procedures within disaster management at the time, along with approaches that addressed technical issues instead of the deeper causes of disaster vulnerability. Since then, the search for resilience-informed architectural solutions has spread within a humanitarian sector which, as previously noted, has become increasingly shaped by privatised and corporate interests, and the celebration of market-based approaches. In particular, the building of disaster-resilient housing has become central in large-scale resilience-building programmes, which, ranging from innovative disaster mitigation responses to long-term livelihood programmes, contribute to decentralising the management of risk (UNDP 2022). These responses, as such, remain embedded in conditions and norms that can be traced back to the 1970s, as has been shown. Such findings shed new light on today's disaster responses. On the one hand, alongside other historical perspectives on humanitarian innovation (such as Tom Scott-Smith's contribution to this special issue), they reveal how design has positioned itself as a discipline capable of offering solutions to complex issues long before the current embrace of design within the broader humanitarian innovation turn. This counters celebratory narratives of newness and instead exposes a longer history of cross-border trial and error conducted across a wide range of disaster-prone regions, along with the persistence of circumcised conceptions of risk. On the other hand, the case studies highlight how designerly efforts to effect transformational change can also be traced in humanitarian responses in the period studied, albeit constrained by several limitations. This exposes the many overlapping ideas that have constituted innovation historically, underscoring the need today to critically evaluate the potential for design practices to expand notions of agency, responsibility, and justice in disaster responses and humanitarian aid more broadly, in contexts shaped by longstanding conditions of 'polycrises' (Bojadžijev and Mezzadra 2023).

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Notes

1. While this article uses the term 'natural' disasters, it recognises the discursive power of language, which has compelled many disaster studies scholars to contend that there are no 'natural' disasters, but rather socio-environmental phenomena whose impacts are mediated by enduring histories of structural vulnerability (Remes and Horowitz 2020).
2. In 1977 Cuny contributed to a workshop on disaster technology held by CIDA: National Research Council, 'The Role of Technology in International Disaster Assistance: Proceedings of the Committee on International Disaster Assistance Workshop, March 1977' (Washington, DC: The National Academies Press, 1978).
3. By 1970 Biharis predominantly supported the West Pakistani ruling elite and actively participated in the military action of the Bangladesh Independence War, which contributed to widespread political persecution. This included the dispossession of property, which led more than a million Biharis to be housed in camps by 1972 (Prasad 2010, 247).
4. As noted in one of the project's reports regarding the failed enlargement of a local school, 'the attitude in the Alcaldes office is that the community is poor and the government promised seven classrooms' (CMU/Intertect n.d.).

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