Architectural Behaviorology for Shelter as Tools for Living in the 21st Century Reader

Chair of Architectural Behaviorology
Chair of Elli Mosayebi
BUK
Master's Thesis FS24

CONTENTS

ARCHITECTURAL BEHAVIOROLOGY FOR SHELTER AS TOOLS FOR LIVING IN THE 21ST CENTURY

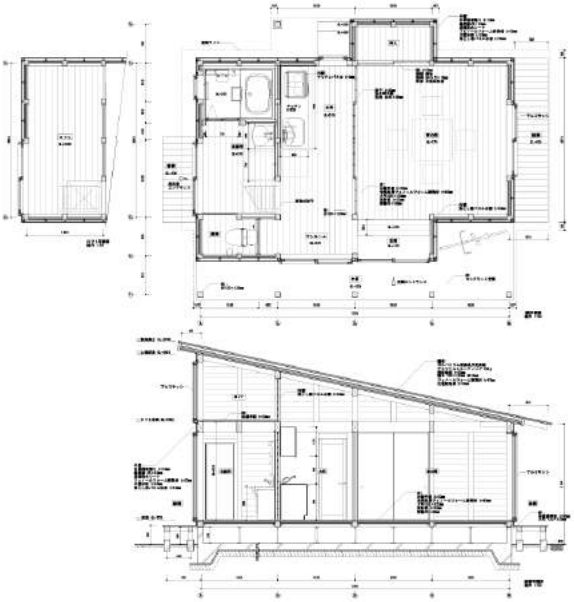

Fig. 01: Archiaid: Core House in Ishinomaki, Miyagi Prefecture, Japan(2012)

We have built shelters as tools for living and adjusting the environment to support our daily lives. Their sustainability is not only a technical or functional issue but also has cultural and historical significance. By maintaining them, people ensure their meaning of life, identity, and creativity. However, sometimes people lose their shelters due to natural disasters such as earthquakes, typhoons, floods, or human casualties such as wars and fires. For us, it is the loss of a significant tool for survival, a proof of our life, or a way of trying to live, and it brings a great sense of loss. It is also the process of recovering from the grief and pain of loss due to such disasters that we build shelters. Building a shelter teaches us the possibility of making something out of nothing, rediscovering our own repeated trajectories, and sharing the process and construction with those who have contributed to it, showing them that they can share the joy of its realization and the security of their lives. What form can such a shelter take? There is no single answer. It will depend on the conditions of the disaster, the climate, the limited materials, technology, the skills available, the economic situation, the urgency, and the creative challenge.

In the 21st century, global environmental change and disasters raise questions about where we can-live. Where should we live? How should we live? What materials will be selected, how will they be processed, and with whom will they be built? How to build shelters is a hypothesis and a practice for rethinking our way of living.

In our studio, each student is asked to select a site under the influence of disaster or global environmental change and analyze and express its design conditions through an actor-network drawing. After the initial research, each student is expected to propose a shelter answering the site's specific requirements, including a program that will indicate a way of living in the 21st century. The chosen site should be easily accessible to allow for field research and the scale of the proposed shelter must be manageable to have enough time to develop the architectural details and the construction process, as the final result should work as an applicable prototype for future disasters to be shared as open knowledge. For the final submission, the proposal for the shelter will be shown as a drawing, including details, the surrounding environment, and the way of life that the shelter will enable.

SCHEDULE

		D-ARCH PROGRAMM		STUDIO PROGRAMM
Week	**Date**	**Programm**	**D-ARCH Grading**	**Schedule**
Week 1	Mon 05.02.	Hand-out of Master's Thesis Programm		08:00 - 10:00 Orientation Theme discussion
Week 2	Mon 12.02.			Desk Critique
Week 3	Mon 19.02.			**1ST MID REVIEW**
Week 4	Mon 26.02.		40 %	Desk Critique
Week 5	Mon 04.03.			Desk Critique
Week 6	Mon 11.03.			**2ND MID REVIEW**
Week 7	Mon 18.03.			SEMINAR WEEK
Week 8	Mon 25.03.	End of Preparation Phase Start of Elaboration Phase Colloquium, Tue 26.03.		Desk Critique
Week 9	Mon 01.04.	Decision whether Students continue or interrupt the MT		EASTER HOLIDAY
Week 10	Mon 08.04.			Desk Critique
Week 11	Mon 15.04.	Sechseläuten (Afternoon)		Desk Critique
Week 12	Mon 22.04.		60 %	**3RD MID REVIEW**
Week 13	Mon 29.04.	1.May, Wed 01.05.		Desk Critique
Week 14	Mon 06.05.	Auffahrt, Thu 09.05.		Desk Critique
Week 15	Mon 13.05.			Desk Critique
Week 16	Mon 20.05.	Pfingsten, Mon 20.05. Submission of MT, Fri 24.05.		**FINAL SUBMISSION FRIDAY 24.05.2024, 18.30**
Week 17	Mon 27.05.	Colloquium (Afternoon)		**FINAL REVIEW**
Week 20	Mon 17.06.	Notenkonferenz		KRITIK MASTERARBEITEN 17.06.2024

SCHEDULE

	CAB/CEM 70%	BUK 30%	CAB/CEM+BUK 100%
Content	**Deliverables**	**Deliverables**	**Grading**
Studio Introduction	Presentation of topic and site by students		
Site Analysis Image of the Place	Draft Area AND		10 %
	Draft Area AND program of shelter	Construction analysis (1:10)	
Site Analysis Image of the Place	Area AND program of shelter		
Site Analysis Image of the Place	Area AND program of shelter	Construction analysis (1:10)	30 %
	Area AND program of shelter First Design Ideas	Construction analysis (1:10)	
Form, Structure, Detail	Plans, Sections, Elevations Model (1:20)		
Form, Structure, Detail	Plans, Sections, Elevations Model (1:20)	Detail (1:10)	30 %
Form, Structure, Detail	Plans, Sections, Elevations Model (1:20)		
	Project AND Plans, Sections, Elevations Model (1:20)	Detail (1:10)	
Production of final hand-in	Project AND, Area AND Plans, Sections, Elevations Model (1:20)		
Production of final hand-in	Project AND, Area AND Plans, Sections, Elevations Model (1:20)	Detail (1:10)	
Production of final hand-in	Project AND, Area AND Plans, Sections, Elevations Model (1:20)		30 %
	Area AND, Project AND, Plans, Sections, Elevations, Model (1:1–1:20), concept text	Detail (1:10)	

PRACTICAL INFO AND SUBMISSION GUIDELINES

Teaching formats

The Reviews and weekly critiques are held on Monday. In the morning desk critiques will be used to share all the students' ideas, and optional individual desk critiques will be held in the afternoon.

Preparation and Elaboration phase in key-words

Chair of Architectural Behaviorology & Chair of Elli Mosayebi

- Architectural Behaviorology
- Actor-Network Drawing (Area / Project)
- Construction
- Disaster
- Climate Change
- Emergency
- Shelter
- Community

BUK

- Durability of the use of materials and construction (structure, building envelope, fit-out)
- Change of the environmental conditions
- Comfort and energy
- Constructive loci: plinth, wall, opening, roof (isometric drawing in scale 1:10)

Grading ratios

Students will be evaluated based on four submissions:

Preparation phase:	40% (1st Mid Review 10%, 2nd Mid Review 30%)
Percentage Partner 1+2 / CAB & CEM:	70%
Percentage Partner 3 / BUK:	30%
Elaboration phase:	60% (3rd Mid Review 30%, Final Submission 30%)
Percentage Partner 1+2 / CAB & CEM:	70%
Percentage Partner 3 / BUK:	30%
Number of Credits:	30 ECTS

Contact

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PRACTICAL INFO AND SUBMISSION GUIDELINES

Submissions

For the Mid Reviews and the Final Submission we ask you to submit all the data of your project on Polybox, following the guidelines below.

Deadlines

All drawings, model photos, etc. have to be submitted on time and must be uploaded to Polybox by 6 pm the night before each review (except the Final Submission). If a submission cannot be made for technical reasons, please contact the assistant before the submission deadline.

Filenames

Please name all files in the following format:

“YYMMDD_24FS_Event_Surname Name_Description.pdf”

Date of hand-in: YYMMDD (Year, Month, Day) e.g. 19th of February 2024 → 240219
Letter code of the semester: 24FS
Event: Mid Review 1, Mid Review 2, Mid Review 3, Final Submission
Name: Surname Name
Description: Actor Network, Model, Plan, etc.

Example: “240219_24FS_Mid Review 1_Muster Max_Actor Network.pdf”

Access to BUK server

You will find further information and references on the student server of the BUK chair, accessible at the following paths:

smb://nas22.ethz.ch/arch_iea_buk_diploma

NOTE: If you want to access the server from home or from other locations outside the university you need to use a VPN connection.

Access to Polybox server

You have to submit all the data on the Polybox server, accessible at the following link:

https://polybox.ethz.ch/index.php/s/63UiNAq8AsJhswy

GRADING AND EVALUATION SHEET

Grading Sheet Master's Thesis - Chair of Architectural Behaviorolgy, Chair of Elli Mosayebi and BUK FS 2024

Student:		...	...		Date:	...				
Partner 1:		Chair of Architectural Behaviorology, Momoyo Kaijima / Basil Witt						Student		
Partner 2:		Chair of Elli Mosayebi, Elli Mosayebi / Nelly Pilz								
Partner 3:		BUK Dozentur Mettler, Studer / Yufei He					Maximal Points	Points	Grade	Total
		Hand in	Critera							
PREPARATION 40%	PARTNER 1+2: 70%	1st Crit (10%)	Submission				4.00	0.00		
				Understanding method Arch. Behaviorology			0.40	0.00		
				Research			0.40	0.00		
				Design			0.40	0.00		
				Visualisation			0.40	0.00		
				Structure and Material			0.40	0.00		
			Submission delay				-0.25	0.00	0.00	0.00
		2nd Crit (30%)	Submission				4.00	0.00		
				Understanding method Arch. Behaviorology			0.40	0.00		
				Research			0.40	0.00		
				Design			0.40	0.00		
				Visualisation			0.40	0.00		
				Structure and Material			0.40	0.00		
			Submission delay				-0.25	0.00	0.00	0.00
		Grade CAB & CEM								**0.00**
	PARTNER 3: 30%	1st Crit (10%)	Submission				4.00	0.00		
				Research of present constructions			0.40	0.00		
				Analysis of durability of choosen detail			0.40	0.00		
				Complexity of choosen detail			0.40	0.00		
				Understanding of building procedure			0.40	0.00		
				Visualisation of constructive elements			0.40	0.00		
			Submission delay				-0.25	0.00	0.00	0.00
		2nd Crit (30%)	Submission				4.00	0.00		
				Research of present constructions			0.40	0.00		
				Analysis of durability of choosen detail			0.40	0.00		
				Complexity of choosen detail			0.40	0.00		
				Understanding of building procedure			0.40	0.00		
				Visualisation of constructive elements			0.40	0.00		
			Submission delay				-0.25	0.00	0.00	0.00
		Grade BUK								**0.00**
	100%	**Grade CAB & CEM+ BUK**								**0.00**
		Grade Rounded CAB & CEM + BUK								**0.00**
ELABORATION 60%	PARTNER 1+2: 70%	3rd Crit (30%)	Submission				4.00	0.00		
				Understanding method Arch. Behaviorology			0.40	0.00		
				Research			0.40	0.00		
				Design			0.40	0.00		
				Visualisation			0.40	0.00		
				Structure and Material			0.40	0.00		
			Submission delay				-0.25	0.00	0.00	0.00
		Final hand-in (30%)	Submission				4.00	0.00		
				Understanding method Arch. Behaviorology			0.40	0.00		
				Research			0.40	0.00		
				Design			0.40	0.00		
				Visualisation			0.40	0.00		
				Structure and Material			0.40	0.00		
			Submission delay				Fail	0.00	0.00	0.00
		Grade CAB & CEM								**0.00**
	PARTNER 3: 30%	3rd Crit (30%)	Submission				4.00	0.00		
				Construction development as part of the design process			0.40	0.00		
				Understanding of building procedure			0.40	0.00		
				Visualisation of constructive elements			0.40	0.00		
				Quality of materials and connections			0.40	0.00		
				Relationship with current building culture			0.40	0.00		
			Submission delay				-0.25	0.00	0.00	0.00
		Final hand-in (30%)	Submission				4.00	0.00		
				Construction development as part of the design process			0.40	0.00		
				Understanding of building procedure			0.40	0.00		
				Visualisation of constructive elements			0.40	0.00		
				Quality of materials and connections			0.40	0.00		
				Relationship with current building culture			0.40	0.00		
			Submission delay				Fail	0.00	0.00	0.00
		Grade BUK								**0.00**
	100%	**Grade CAB & CEM + BUK**								**0.00**
		Grade Rounded CAB & CEM + BUK								**0.00**
100%		**Final Grade CAB & CEM + BUK**								**0.00**
		Final Grade Rounded CAB & CEM + BUK								**0.00**

GRADING AND EVALUATION SHEET

Grading Sheet | Master's Thesis - Chair of Architectural Behaviorolgy, Chair of Elli Mosayebi and BUK | FS 2024

Student:	...	...	Date:	...
Absence:	0			
Conclusion:	0			

Student Signature: _____

With their signature, the student confirms to understand the above shown grading table and agrees to the statements formulated in the conculsion

ACTOR NETWORK DRAWING REFERENCES

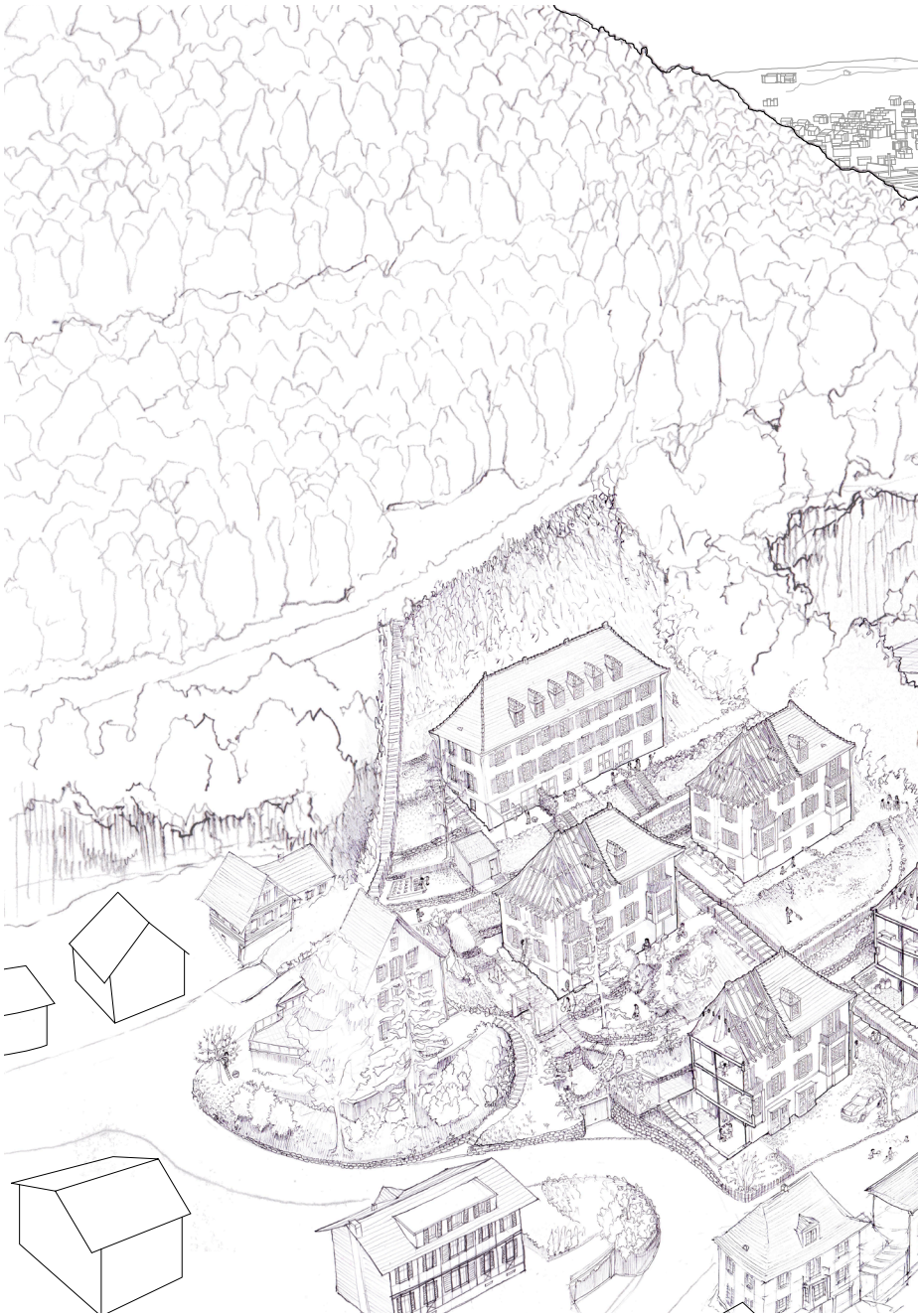
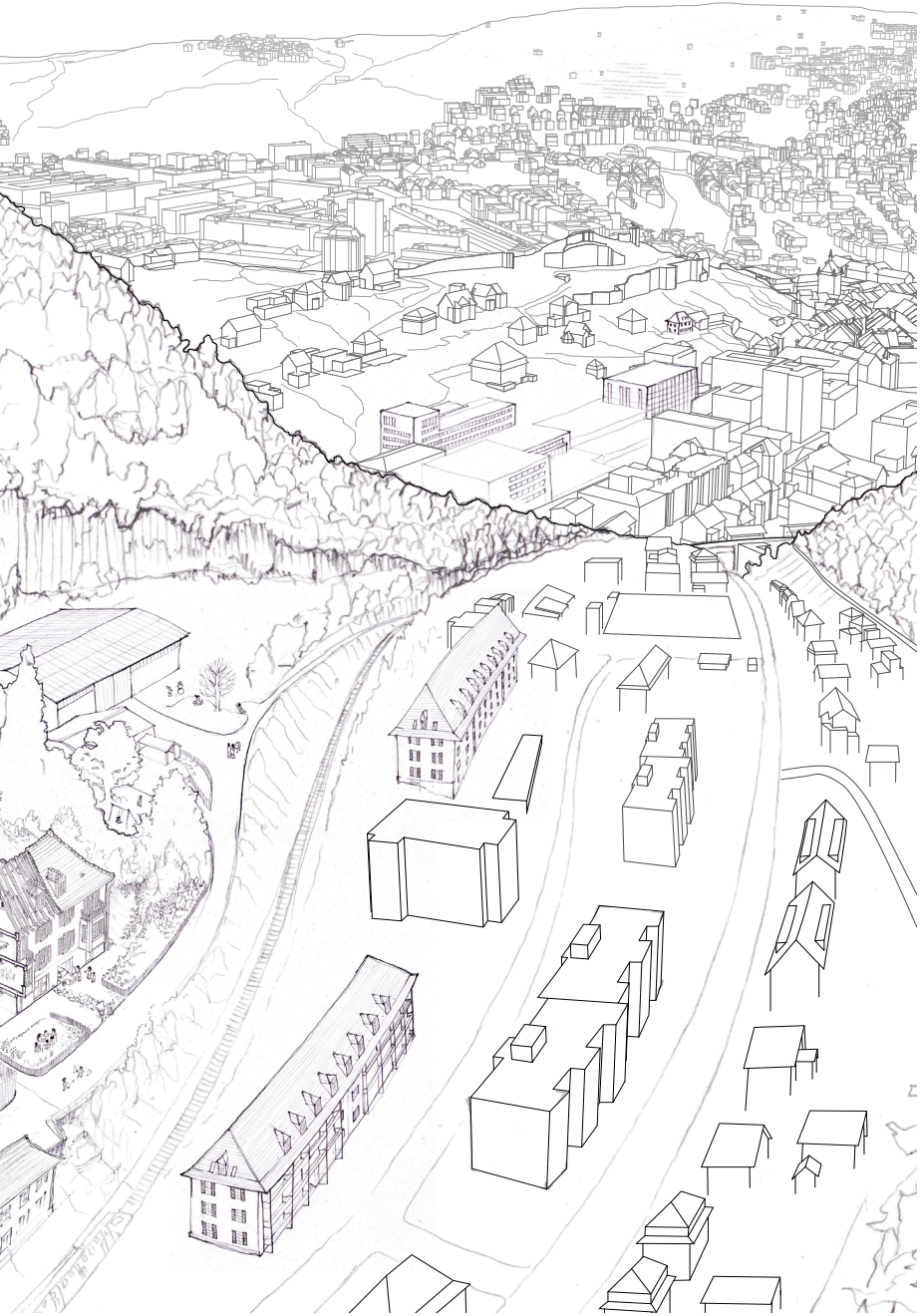


Fig. 02: Actor Network Drawing, Diploma FS23 Living on Terraces (Hannah Kilian, ETHZ)

ACTOR NETWORK DRAWING REFERENCES



ACTOR NETWORK DRAWING REFERENCES

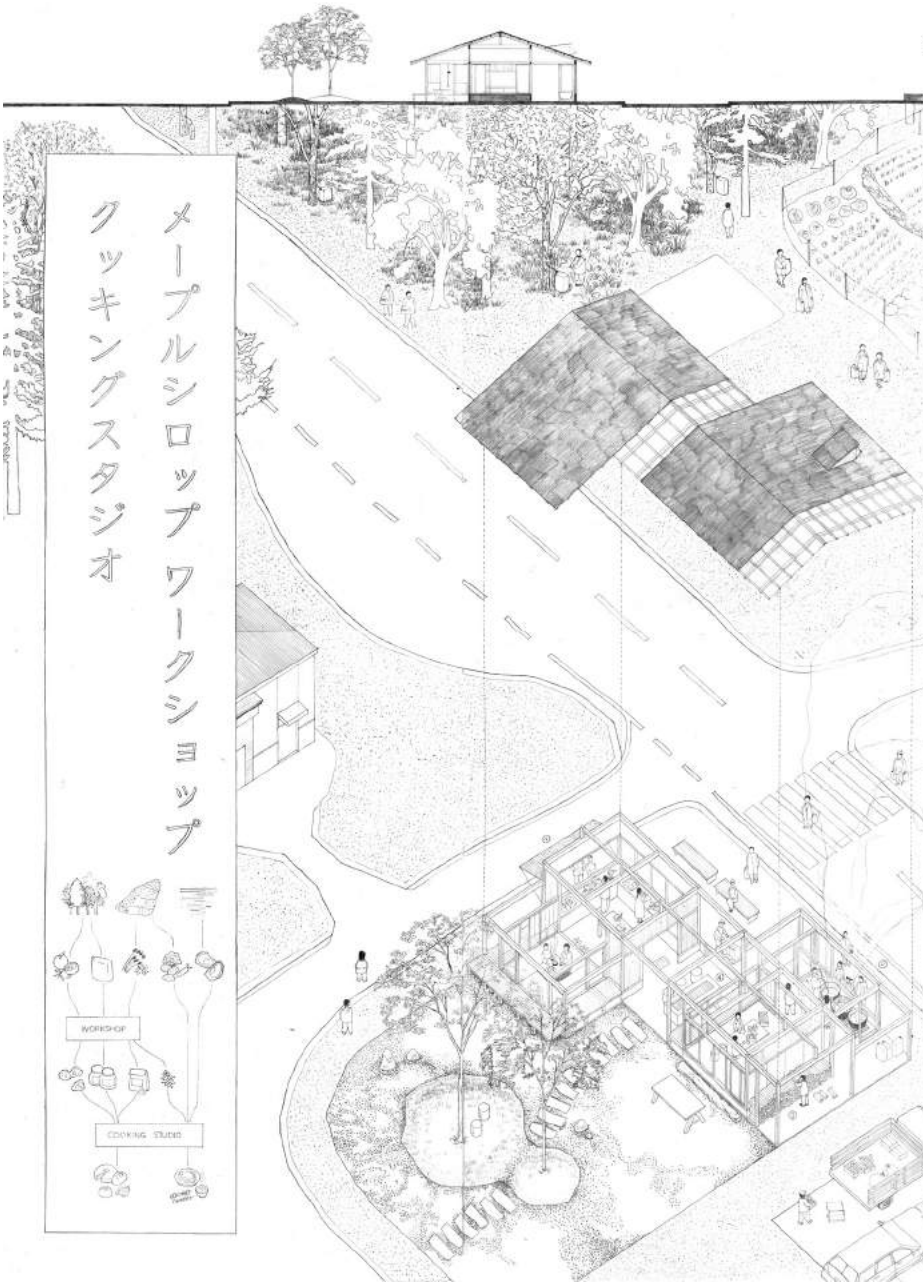
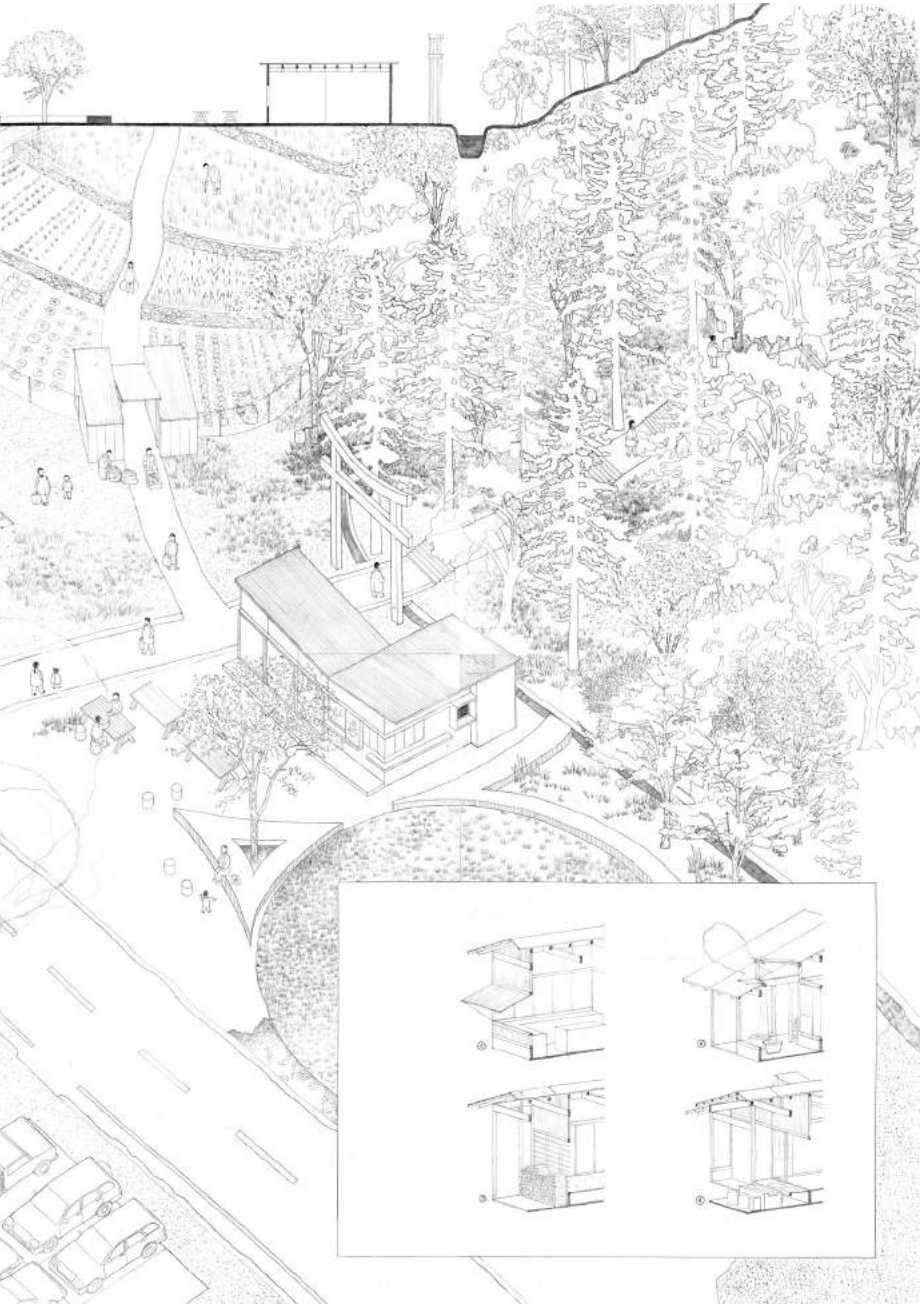


Fig. 03: Actor Network Drawing, HS19 (Yuni Zhao, ETHZ)

ACTOR NETWORK DRAWING REFERENCES



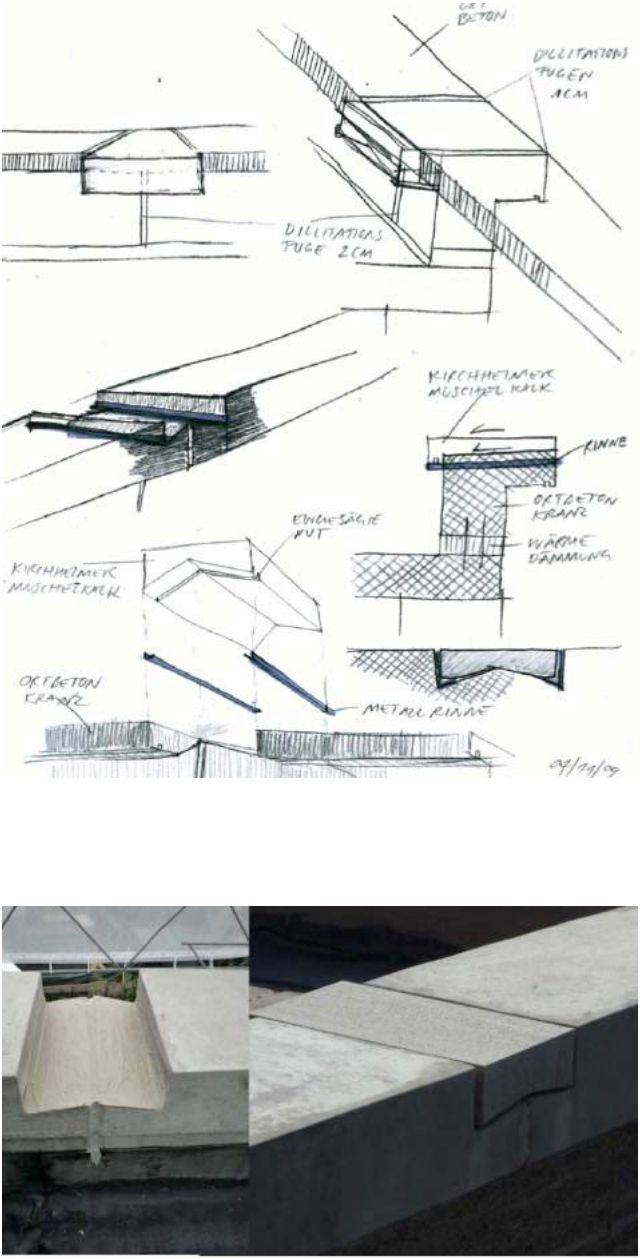
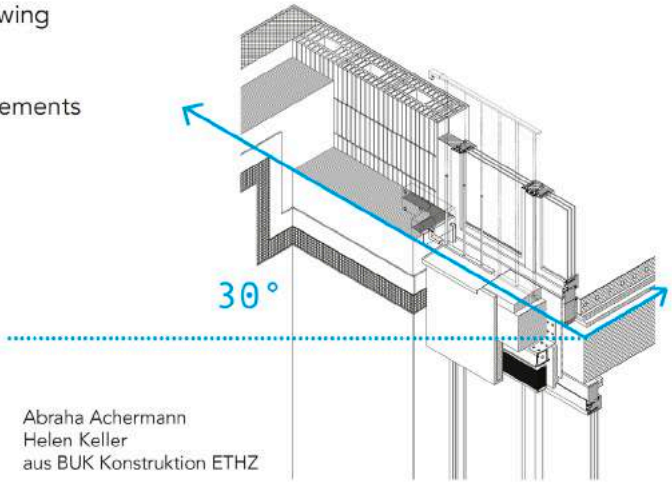


Fig. 04: The Drawing as a tool for controlling construction and expression during the design process. It is directly linked to the design. (Käferstein & Meister Architekten, Haus in K.)

Isometric drawing

- 30°-angle
- true measurements readable



Isometric drawing

- Building process is visible through layering

- Load bearing elements
- Insulation
- Sealing
- Protection / Covering

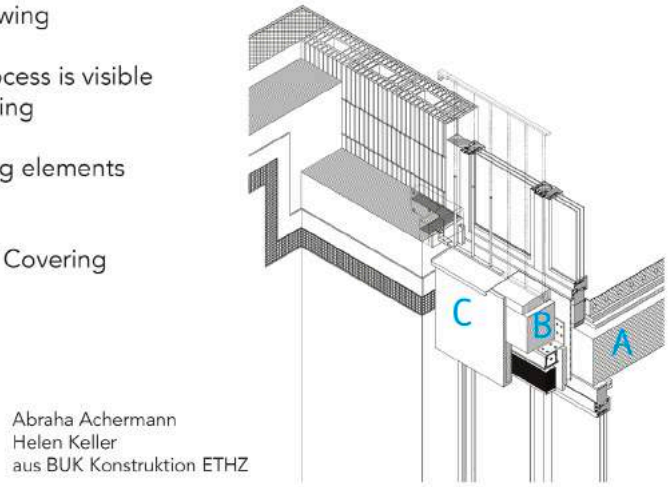
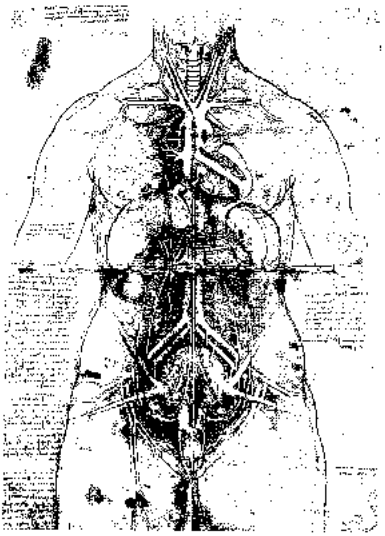


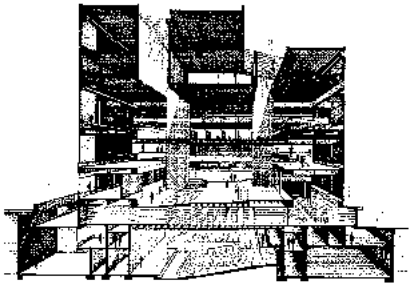
Fig. 05: Reference for an isometric drawing (BUK Konstruktion ETHZ)

Fig. 06: San Antonio Market, Barcelona, 1955 (theguardian.com)

READINGS



レオナルド・ダ・ヴィンチ　女性内臓図
Leonardo da Vinci, Principal Organs of a Woman



ポール・ルドルフ　イエール大学芸術・建築学部
Paul Rudolph, Yale Art and Architecture Building

“GRAPHIC ANATOMY 2 ATELIER BOW-WOW”
Atelier Bow-Wow

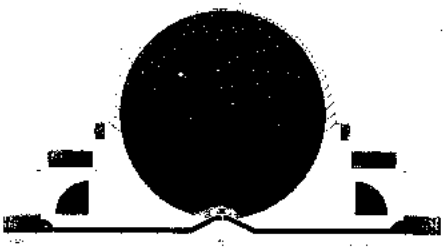
Leonardo da Vinci is known to have sketched dissections that he observed and conducted himself in order to better understand the internal structure of the human body and to draw livelier human figures. Inspired by such medical/artistic anatomical illustrations, we attempted to draw architectural anatomical illustrations. What resulted was *GRAPHIC ANATOMY ATELIER BOW-WOW*. A question that we are often asked in regard to these illustrations is: “In which phase do you make these drawings? During design? During construction, to give instructions to the site? Or after the project is completed?” Apparently, this practice of ours seems odd to the eyes of others.

What we refer to here as “illustrations” are detailed section and plan drawings to which we have given depth through the use of one-point perspective and added incidental details that include people, furniture, fixtures, plantings, vehicles, and buildings in the surroundings. Typically, detailed section and plan drawings are made for the purpose of holding meetings with contractors during the design or construction phases, while perspective drawings are drawn in order to convey the contents of a project proposed for construction to clients, local residents, or potential users. Both are made at a time anterior to the completion of the architectural construction in the interest of establishing better communication between the involved parties. By contrast, our illustrations depict in considerable detail the particulars of elements that can only be observed when an architectural construction is completed and it begins to be used, such as the behaviors of the people inside and outside it, everyday items, pieces of urban space glimpsed through its windows, and the interstices between it and its neighboring buildings. The *space of representation* and the *space of occupation* (Henri Lefebvre), which are respectively planned anteriorly and observed posteriorly to when an architectural construction is completed, are superimposed on a single drawing. In light of this, we should be able to re-interpret the earlier question as: “What enables the intermixing of the planned and occupied spaces that belong to differing temporal orders?”

Here we will examine this question through comparing and contrasting the genealogies of various drawing methods and architectural representations from throughout history and the world.

The drawings in *GRAPHIC ANATOMY ATELIER BOW-WOW* fit into the genealogy of so-called “section perspectives”. If we trace the genealogy of these drawings, we will first arrive at the series of works by Paul Rudolph (1918-1997). His section perspective drawing of the Yale Art and Architecture Building (1963) is particularly brilliant. Through it, we can grasp all at once the three-dimensional interrelationships of the spatial components and the bold structural format that supports them. While details such as furniture and everyday items are not depicted, small silhouette figures indicate the enormousness of the interior space through contrast. The same drawing technique was employed regularly at the time by architects in Japan, too. This occurred in conjunction with a contemporaneous contextual current that brought the giantification of architecture. The very way in which these drawings were drawn had sparked the imagination of viewers into envisioning architecture as growing larger and larger to the extent that it might incorporate the city into itself and reach the point where *Architecture = City*. Conversely, the idea of architecture expanding to the scale of a small city had also been synonymous with the idea of the city shrinking down to the size of a single building.

By comprehensively presenting the complex entirety of a building with a single section cut, a section perspective constructs a space that cannot be experienced in reality inside the mind of an observer. A perspective drawn of an unfinished architectural construction would construct a space that *has not been experienced*, in the sense that it does not yet exist in the world; however, in the case of a section



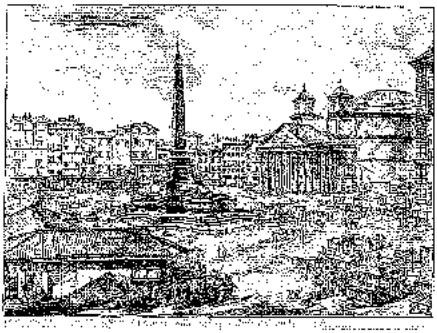
エティエンヌ・ルイ・ブーレー　ニュートン記念堂 *2
Étienne-Louis Boullée, Cenotaph for Isaac Newton

perspective, the space it constructs *cannot be experienced* in the sense that the very viewpoint of the drawing would be unachievable in reality. Something which has not been experienced or cannot be experienced is commonly called a *vision.* A vision provides the driving force behind advancements, as was demonstrated by how Steve Jobs' tireless pursuit of his visions had inspired the engineers and designers who assisted him to create the numerous products of Apple Inc. Rudolph's section perspectives can be seen to have presented visions for *Architecture = City* (Architecture is the City; the City is Architecture). They represent the architect's response to the gigantification of architecture that had been taking place within the social and economic context of his time.

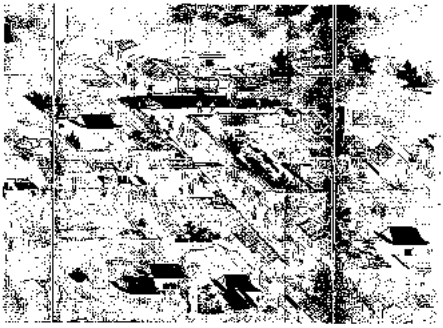
In contrast to how Rudolph's visions have been entrusted to real projects, the series of works drawn by the 18th-century French architect Étienne-Louis Boullée (1728-1799) express visions that stand on their own as projects through their representation.

Boullée lived at a time when the current of Neoclassicism marked by logicality and austerity was starting to spread as a reaction against the Rococo style that had taken root during the reign of King Louis XV. He was not blessed with realized works, but, just as his nickname of the "visionary architect" suggests, he left behind imaginary projects for enormous architectural constructions. The Cenotaph for Isaac Newton was one of such project. Newton was the great celebrity of the 17th century who had put forward his visions to various fields such as physics and astronomy and then proved them. Let us consider his contribution to the subject of gravity, for example: While Johannes Kepler (1571-1630) had already pointed out that gravity existed, his understanding of it had still been on the level of observational experience (e.g. seeing an apple fall from a tree). Newton, however, established the basis for our modern understanding of gravity by recognizing that a gravitational force is present when there are two bodies with mass (an apple and the Earth) exerting attractive forces on one another and the mass of one body (the Earth) is markedly larger than the other. In order to actually observe this, he would have needed to have gone into outer space to look at the whole Earth. This was impossible to do, and anyhow, the apple would have been too small to see. Yet he could still imagine the relationship between them inside his mind. This had given him the liberty to think about the Earth and space without relying on direct experience. Newton subsequently extended his imagination to envision the solar system's structure, which is constituted by the relationships between the orbits of the Sun and planets. Boullée's cenotaph that celebrates Newton's such accomplishments contains a perfect sphere of a size that far surpasses the scale of the human body. His section drawing is drawn along a cut-plane that intersects the space of this sphere at its great circle (a plane that coincides with a diameter of a sphere). Its interior is made to become a planetarium that expresses the starlit sky as light shines through the numerous holes that have been punctured throughout the walls which become thinner closer to the top of the dome. It literally represents a vision of *Architecture = Space.* Perhaps somewhere in his mind, Boullée had been picturing an overlap between Newton and his own architecture while hoping that a revolutionary occurrence of a magnitude as great as the shift in understanding that Newton had brought about would take place in architecture.

Boullée sublimated stylistic Neoclassicism into compositions of geometric forms, and as a result, his architectural visions show a tendency toward a departure from the architectural vocabulary of the past. Contrastingly, Giovanni Battista Piranesi (1720-1778), who had lived in almost exactly the same age as Boullée, is known less for the architecture that he designed himself than for his series of copperplate etchings of ancient Roman ruins, Rome's historical monuments, and his imaginary prisons.



ジョヴァンニ・バッティスタ・ピラネージ　ローマの景観：ロトンダ広場
Giovanni Battista Piranesi, Veduta della Piazza della Rotonda

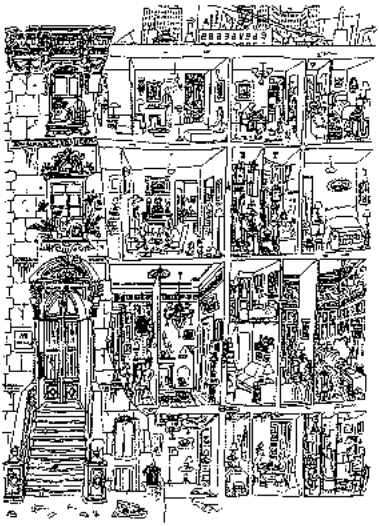


狩野派　洛中洛外図屏風（一部）
Kano School, Rakuchu-Rakugai Folding Screen Paintings (parts)

His perspectives of Roman ruins depict not only the dilapidated structures, but also the weeds that have taken root in them, people who mill around among them, and unearthed antique artifacts that have been piled up disorderly in piazzas and along roads. While the subjects of his etchings show a level of accuracy reflective of the regional geographical and archaeological surveys of Rome on which they were modeled, there are many instances where he has represented them in altered positions and exaggerated sizes. Among similar examples of drawings made based on survey measurements of ancient Roman ruins are the reconstruction drawings of the Prix de Rome recipients from the French Academy who had been sent to Rome during the same time period. Compared to how their drawings were made to converge toward the original forms of the depicted subjects by imaginatively filling in the parts that had been lost, Piranesi's copperplate etchings are rich with a sense of invention and playfulness that reflects his interest in cultivating the possibilities hidden in the things that he observed. These copperplate etchings served as landmark illustrations and antique catalogs for the English nobility who visited Rome on the then-popular Grand Tour, and some of the plates are known to have been used to mass-produce as many as 4,000 prints. Seemingly as if to re-create how the real city had formed through history, Piranesi presents elements in his perspectives that had the possibility of existing in the constructed sites that they depict, without distinction between past and present, and he accelerates and augments the latent hypothetical ideas in the urban space to produce fantastical scenes that are not entirely impossible, if albeit more overblown than reality. They reflect analogical visions that position the past and present within the same framework.

In tracing the genealogy of representations like Piranesi's etchings that depict the lives of people in a city as observed together with the architecture around them, there is nothing that we find to be more interesting than the Rakuchu-Rakugai folding screen paintings that were produced by the Kano school of painters during the Sengoku to Edo periods. While these representations do not reflect the disciplinary body of knowledge specific to architects and technical experts, they generally employ the drawing method of the oblique projection (often used in presentations by OMA) that preserves the elevation. Scenes of everyday life and festivities unfolding inside shops and on the streets along thoroughfares lined with the *machiya*-type townhouse buildings of Kyoto are depicted with a sense of synchronized liveliness. The behaviors of the people, which seem to be occurring even beyond the frames of the folding screens, each constitutes a small part of the whole, and the spaces between them are filled with golden clouds. Unlike the perspectives that we have examined previously, neither a center identifiable by a vanishing point (i.e. the position of the observer) nor differences in the sizes of objects caused by depth perception are apparent in these paintings. They do not call out the identity of the observer or assign weight to the depicted subjects. In other words, the unavoidable integration of time and space that occurs within any physical experience, which requires us to be in one place (now) at one time (here), is cancelled. The oblique projection instead generates a sensation that both time and the subjects have been set out side by side en masse. By capitalizing upon this quality, these paintings present paradigmatic visions in which the potential variations of the forms that could be assumed by the subjects and the potential variations of the behaviors that could occur are laid out in parallel with equal weight and in the same moment.

A city is a place where there is an inherent demand for this parallelism of time and space. The book *La Vie mode d'emploi* (*Life: A User's Manual*) (1978) by French novelist Georges Perec (1936-1982) represents a literary elaboration of this vision. He received his inspiration for the novel from Saul Steinberg's drawing



ソール・スタインバーグ　ダブリング・アップ
Saul Steinberg, Doubling Up

今和次郎　震災バラックのスケッチ
Wajiro Kon, Sketch of Post-Earthquake Barracks

祝代近一郎研究室　伊根の集落
Yuichiro Kojiro Research Laboratory, Village of Ine

titled "Doubling Up" (1946) that he saw in *The Art of Living* (1949). Perec attempted to depict a building with its façade removed, just like in the drawing, by establishing a 10×10 grid of rooms and making stories for each room by adhering to combinations of constraints generated from a pre-defined list.

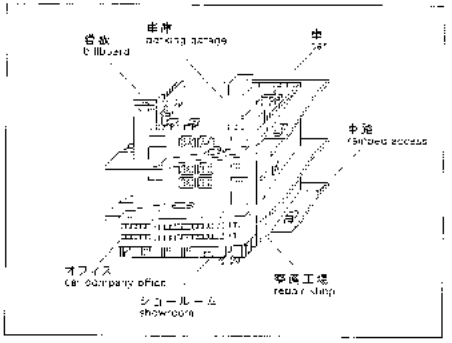
Let us examine Steinberg's drawing closely. The contents of each room are drawn with perspectival depth. Generational differences, differences in family compositions, differences in wealth, and differences in values are all depicted inside the single apartment; for example, it shows the life inside a high-ceilinged room overflowing with luxurious furniture and interior décor on the second floor; the frugal life of an elderly couple living with their cat in a low-ceilinged room on the first floor; the life of a family with children on the third floor; and the lives of bachelors and young couples on the top floor. The drawing can be said to be expressing a sociological vision in the sense that, rather than describing the architecture as existing inside society, it describes the multifariousness of society that has flooded into the architecture.

The visions presented by the Rakuchu-Rakugai folding screen paintings and Steinberg's drawing reflect a common interest in the posterior realm (i.e. space of occupation, as opposed to the anterior realm as discussed at that beginning of this disquisition), and genealogically, they tie into Wajiro Kon's modernology, Tsuneichi Miyamoto's folkloristics, and cultural anthropology. What served to connect this same interest to the genealogy of the study of architecture were the design surveys carried out on traditional villages and traditional architectural constructions. It should be noted that the aforementioned reconstruction surveys of ruins that were conducted by the Prix de Rome recipients, Piranesi's fantastical copperplate etchings, and the Rakuchu-Rakugai folding screen paintings that show a medley of human behaviors all had a design survey aspect to them in the sense that they were based upon observations of already-existing buildings and urban space; however, they were oriented in a different direction. This difference can be attributed to the differences in the contexts or backgrounds against which they were drawn.

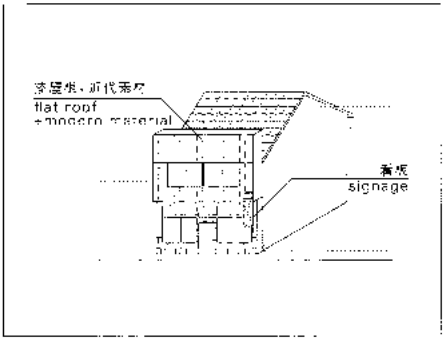
The rise of design surveys particularly in the 1960s was backed by a critical atmosphere that had developed against architecture and the city after modernization. People began to realize that the functionalist architectural constructions and urban spaces that had been promoted and established during modernization were starting to grow beyond humanistic scales (i.e. giantification) and that they lacked a feeling of warmth suitable for living, an organic quality necessary for achieving unity between a place and its regional land and climate, and a sense of complexity in which diverse values can stably coexist.

The dangers had become apparent, for example, of replacing a neighborhood in a city that had been shaped by small closely-knit shops and houses with a large-scale architectural development. This caused the boundaries between the architectural constructions and the streets to harden and to lose their character as permeable thresholds that interpenetrated between both realms, and this in turn deprived people of the room to behave autonomously and threatened to even sever the repetition of their daily routine behaviors. If people cannot repeat their behaviors, their bodies cannot settle into or occupy a place, and the time that they spend practicing their behaviors will not aggregate to form the qualities needed to make a space of comfort. This shows that the aforementioned anterior and posterior conditions are by no means unrelated and that the framework of the anterior planning can prescribe the possibilities for the posterior occupation.

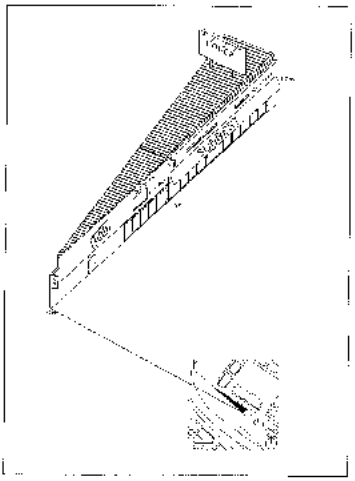
This was what led architects and researchers in the 1960s to go out into the field to conduct observations and inquiries in an attempt to better understand the preeminent appeal of the traditional villages and architectural constructions that had been shaped over the generations. These design surveys were thus



「メイド・イン・トーキョー」
Made in Tokyo



「アトリエ・ワンと歩く 金沢、町家、新陳代謝」
Walking with Atelier Bow-Wow Kanazawa Machiya Metabolism



「ペット・アーキテクチャー・ガイドブック」
Pet Architecture Guide Book

connected to each other at a basic level by the demand of the time to reexamine planning from the aspect of the space of occupation.

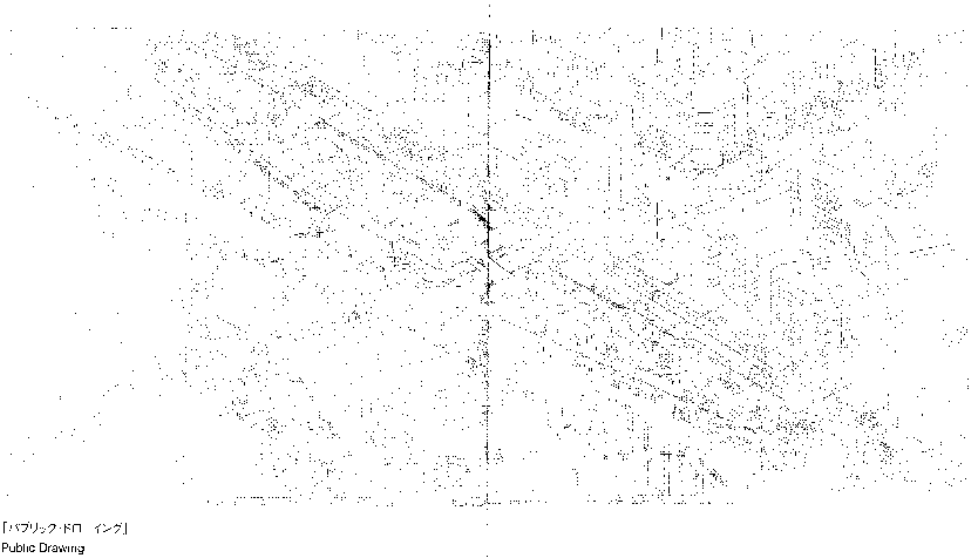
As no plans or unifying designer existed in such villages, the architects and researchers took photographs, made first-hand sketches, collected measurements, and put their knowledge of construction methods to use for parts that they could not see to produce more accurate plan, elevation, section, and section detail drawings. It was common for them to also record the miscellaneous objects that occupied the spaces, such as furniture, stone flooring patterns, animal pens, plantings, and scattered day-to-day items. These assortments of miscellaneous objects contain hidden systems of order, which formed as the objects found stable positions through the making of repeated decisions that were governed by the residents' livelihoods in their villages, their daily lifestyles, annual festivals, and the local climate. This repetition was guided by how the architecture was composed. An ecological vision in which diverse objects and phenomena are interrelated emerged as a result of depicting all of these elements together.

So far, in this discussion, we have clarified the structure through which a vision emerges: representational drawings have a dimension concerned with the subject (what is drawn) and a dimension concerned with the representational technique (how it is drawn); and a vision (the visualization of something that has not been experienced) emerges through the superimposition of these two dimensions. Before we return to the initial question about our illustrations in *GRAPHIC ANATOMY*, let us take a look at some other drawings that we have made at Atelier Bow-Wow and examine them based on this understanding that we have now established.

At Atelier Bow-Wow, we have regularly employed the same oblique projection technique used in the Rakuchu-Rakugai folding screen paintings to make *manga*-like single-line drawings of buildings in the city. This is a method that temporarily suspends aesthetic judgment and cancels any cultural value that may have been assigned to a building, thereby enabling us to observe without bias how the anonymous architectural constructions that make an urban space exist from an ecological point of view. This is what gave rise to *Made in Tokyo* (2001, Kajima Institute Publishing), which is a collection of Tokyo's hybrid "*Da-me* (no-good) architecture"; and *Pet Architecture Guide Book* (2001, World Photo Press), which is a collection of extremely small architectural constructions. In *Kanazawa Machiya Metabolism* (2007, 21st Century Museum of Contemporary Art, Kanazawa), we compared houses in an old city district using oblique projections to preserve their façades, and we positioned the *machiya* townhouses with their 20th-century modifications into the genealogy of the *machiya* that extends back to the Edo period.

Our "public drawings" provide further examples in which we have utilized the qualities of centerlessness and spatiotemporal parallelism offered by the oblique projection to represent public space. We conceived the public drawings as a way of depicting projects that intervene on the public space, such as Miyashita Park, the Kitamoto Station West Square, and the BMW Guggenheim Lab. These drawings describe an ecological area within the urban space that is centered on the projects. In them, we draw the architectural constructions in the surrounding environment, the roads, the open spaces of the projects, and parks with equal weight and density. Moreover, we have taken the idea of multiplicity in the urban space and put it into practice with the drawing method itself by having multiple people simultaneously draw selected subjects of their choice onto a large sheet of paper with pencils.

The paper surface is also a space. The act of drawing on it with a pencil is accompanied by the body.



「パブリック・ドロ ーイング」
Public Drawing

Obviously, it takes a great amount of time to complete. However, through experiencing this process, one will steadily and surely occupy the space of the paper. The sensation of occupying a space posteriorly to the completion of an architectural construction is thus practiced and fixed onto the paper through the act of drawing.

Now, how can we position the *GRAPHIC ANATOMY* illustrations in relation to the architectural representations that we have examined? The illustrations depict the contents of a project that have been planned anteriorly to its completion, such as the forms, arrangements, relationships, and connections of the spaces which are shown through sections and plans, together with internal technical details which are shown through walls and roofs that have been cut away. Additionally, they depict within the depths of their one-point perspective the contents that are observed posteriorly, such as furniture and everyday items that have been brought into the space, views through the windows, and the behaviors of people. We have overlaid these things that are normally drawn separately with different intentions under different circumstances on a single drawing with the aim to generate some kind of connection between the objects and phenomena that are conventionally divided into the categories of the anterior and posterior or the planned and occupied.

If a certain place is occupied, this means that the behaviors of its multifarious elements (not only people, but also light, wind, heat, etc.) are in a state of equilibrium. The behavior of each element is determined by the relationship between the immanent principle within the element and the context that regulates the extent to which it can perform its behavior (the capable range of the behavior). There is no doubt that what the context determines is largely dependent upon the physical composition of the place in question. The behaviors that are produced again and again within this composition are accompanied by a special framework of time that is in repetition. The distinction between the anterior planning and posterior occupation is relativized through the introduction of this framework that reflects a different sense of value to the framework for linearly-progressing time that demarcates the divide between the front/before and back/after in relation to when an architectural construction is completed. The sense of value introduced by the framework of repetitive time calls for us to examine the faculty of architecture that enables it to bring into equilibrium the multifarious behaviors that have been passed on timelessly throughout the ages—such as the behaviors of nature, the behaviors constructed by people in response to nature, and the behaviors that people have internalized through constructing society—and to open up the knowledge it offers to the practice of architecture today.

We seek to shift away from the anterior/posterior separation of the planning and occupation to instead introduce the framework of repetition that is grounded upon the behaviors that are supported by an architectural composition—this is the vision of our illustrations and, for the time being, our response to the initial question.

[1] Paul Rudolph. *Bauten und Projekte*. Hatje Cantz Verlag, 1970.

[2] Emil Kaufmann. *Three Revolutionary Architects: Boullée, Ledoux, and Lequeu*. Trans. Hidekazu Shirai. Chuokoron Bijutsu Shuppan, 1994.

[3] Michihiro Kojima. *Egakareta Sengoku no Kyoto: Rakuchu-rakugai-zu byobu-e wo yomu*. Yoshikawa Kobunkan, 2009.

[4] Saul Steinberg. *The Art of Living*. Harper and Brothers, 1949.

[5] Meiji University Kojiro Lab and Hosei University Miyawaki Lab. *Fukkoku dezain sabai: Kenchiku Bunka-shi sanroku*. Shokokusha, 2012.

[6] Morroyo Keijima, Junzo Kuroda and Yoshiharu Tsukamoto. *Made in Tokyo*. Kajima Institute Publishing, 2001.

[7] Tokyo Institute of Technology Tsukamoto Architectural Laboratory and Atelier Bow-Wow. *Pet Architecture Guide Book*. World Photo Press, 2001.

[8] Atelier Bow-Wow. *Walking with Atelier Bow-Wow Kanazawa Machiya Metabolism*. 21st Century Museum of Contemporary Art, Kanazawa, 2007.

Architectural Behaviorology

Written by Atelier Bow-Wow
Translated by Steven Chodoriwsky

1. On behaviorology

This book covers the majority of the works of Atelier Bow-Wow to date. The core of our activities has consisted of designing small houses, conducting urban research, and participating in art exhibitions. As these works have been often realized individually and published through various outlets, the relationships between them may appear unclear from an outside perspective. To us, however, this is in no way schizophrenic; rather, projects tend to contaminate, inform, and mutually develop one another. We have never sought to explain our practice in its entirety with overarching meta-theories. Instead, we have posed—and continue to pose—several naive questions:

In spite of Tokyo's complex appearance, why is it a relatively comfortable place to live? In such a mega-city, what is the significance of designing one single, tiny house? As architects who practice here, what can we do from this point on, when a majority of the necessary public urban amenities have been already constructed? … Why is vernacular architecture so much more charming and seductive than the newest buildings designed by famous architects? Why do buildings, designed by architects, tend to stand out from their surroundings? … Why is there so often a misalignment of the positions of user and creator in works of architecture? Why do architects desert users and their surroundings? Why does the doubt that architect's wishes overwhelm the user's wishes persist? What will become of urban space when architects are fascinated first and foremost with new forms of architectural expression? Has harmonious urban space disappeared? Can new types of order emerge that can effectively replace this? What determines the happiness of a building? What is the state of public space today, and what might it become in the future? …

Without knowing exactly how to tackle these questions, we have fortunately had many opportunities to put possible solutions to the test. We have strived to create livable, viable, and enjoyable spaces, all the while addressing several overlapping concerns—architectural expression, architectural dimension, and their complex relationships to capital and generational change. At this point in time, the word "behavior" comes to mind as a recurrent theme in our interests. Behavior could be central to a hypothesis for understanding the correlations between human life, nature, and the built environment. To contrast: the idea of "function" in architecture had developed through the biological understanding of animals' anatomical systems as discovered in a laboratory setting. But in the observation of living things, such methods tend to align more closely with that of the ecological than the functional. It is akin to investigating an animal in its natural habitat, as well as its relationship to other animals within a larger network. This method of study has been taken up not only by biology but also by sociology and anthropology, as they share a common thread in their evaluation of modernity's central axioms. Whereas modernist thought elevated such concepts as self-consciousness and the privilege of the human spirit - often at the neglect of others - an ecological approach to these fields has sought to diminish this imbalance. In fact, most of the questions raised earlier are similarly based on the criticism of such main tenets of modernism. Following this line of thought, the concept of behavior need not apply solely to human beings, and we can discern at least three main classifications relating explicitly to architecture and urban space. Of course, the first is,

still, the behavior of human beings. Next, is the behavior of the natural elements, such as light, heat, water and wind. Third, is the behavior of buildings as observed in their larger context or environment. Behaviorology attempts to place architecture and urban space in a position where these three categories are effectively synthesized.

2. The behavior of human beings, natural elements, and buildings

Human Beings

Within what is surely a broad concept, we would like to concentrate on those daily, repetitive acts of humans which are best observed from a slight distance. Such behavior does not tell of the single individual, clearly expressed and distinct from other beings. Nor does it tell of the mass, where aspects of difference are all but erased. It is between these two, at a scale never completely reducible to that of a single unit, where certain customs and habits can be shared.

Natural Elements

Natural elements, such as light, heat, water and wind, deal with the micro-phenomena of physics, which arise outside of and eventually infiltrate buildings. Enclosed air rises when heated; light reflects off surfaces and moves around corners; heat bridges materials; water flows from higher levels to lower levels. They follow basic laws of physics, acting consistently and dependably—at least compared to the relative whimsy of human behavior. Openings, quasi-exterior spaces, and thresholds between inside and outside are logical gathering places for such behaviors. They can be quite mischievous at times: condensation builds along on a windowsill, or wind flits through a crack. Nevertheless, the rules of nature cannot be changed; what we can do, however, is put their inherent properties to best possible use through architecture. Attuned to nature's stirring, we can obtain a sharper, more enhanced perception of the world.

Buildings

Each building can be viewed as a sentient creature, endowed with its own unique intelligence and a defining set of living characteristics. To deal with a building's behavior is, in a sense, to go back to the original condition where certain typologies were discovered and, later, perpetuated. The requirements of a building's typology—its shared formula of articulation and synthesis, developed under specific conditions—are the direct results of the process of repetitive construction. Whether the correspondence of building practices align with a particular climate, with urban planning policy or with local tax regulation, the result is a formula that retains common characteristics—although the effect is far from uniform. Buildings can be seen as identical on the typological level, while still retaining their distinctive elements. A building's behavior thus cannot be adequately distinguished through its solitary observation, but rather is clarified through the comparison of traits within a larger pool of its peers, siblings, or neighbors.

3. Specific timescales of behavior

The three behaviors outlined above are integrated into daily routine under the premise of repetition, but each carry within them specific timescales and rhythms. For instance, the behavior of natural elements surrounding a building can be adequately observed in a matter of hours, by following, say, the movement of the sun across the sky. In the case of human beings, one day is enough to observe physiological behavior, such as dining and sleeping patterns. For a larger social group such as a company or school, at least one week may be necessary to make sense of its rhythms and routines.

Religious holidays, harvest festival cycles, and other forms of community activity may require an entire year; it may be likewise with seasonal climate change. As such, behaviors change shape depending on the timeframe in question. In terms of a building, it may not be possible to recognize anything clearly regarding its behavior, at least not at the same scale as either humans or natural elements. But within fifty or one hundred years, we can observe how the building's existence has transformed: here, then, its behavior appears. If certain building behaviors are repeated, they may even begin to occupy sizable amounts of territory. And eventually, the proliferation of a characteristic gives rise to urban morphology visible at a much larger scale. Behaviorology attempts to understand this through buildings' typological tendencies, their patterns and influences, and their transformations over time. One clear example of this at work is Tokyo, a city made of houses—and one that has been calamity-free in the over six decades following World War II. As mentioned before, if architecture is favorably positioned to negotiate behaviors of different types, then architectural behaviorology can be seen as the art of synthesizing their disparate rhythms within any single building entity. The vital connection between time and space, eradicated during the twentieth century's orientation to the logic of production, is thus revitalized as a critical pursuit once again.

4. Forms which support behavior

We would like to point out that such a discussion on the behavior of human beings, natural elements and groups of buildings does not objectify the individual building itself. In fact, the building exists only relative to other factors, causing its individuality to disappear altogether. Each is formed according to basic principles of nature, and works to optimize the performance of each factor included therein. In this way, the form of the building is situated to share an ecological relationship with the diverse behaviors of different elements. In order to make architecture intervene in the topic of behavior, form must be reconsidered as a complement to behaviors already in effect. That is to say, the building allows the elements to behave optimally, and consistent with their very nature.

Human beings

We often use the example of furniture and its relationship to the posture of its human users. Take the situation where several people are in a lengthy discussion. The participants, required to concentrate, should be positioned to face one another. This normal setting, where people sit on chairs around a table, is what makes such protracted concentration possible. Here the furniture acts as a jig, positioning the human body for the purpose at hand. After all, a body's orientation consists of both front and back, and the configuration of a chair similarly reflects this fact.

Inside the small houses of Tokyo (where distances between articles of furniture may very well be the shortest in the world), a near-torturous landscape is often produced from the poorly coordinated orientations of various elements. Thus it becomes especially important to integrate, well beyond a building's basic enclosure, a sense of spatial expansiveness that reaches out to the city. Expressing its inherent "open-ness" and "closed-ness" may be achieved through the careful alignment of furniture with openings and walls. In the case of urban public space, the preferable condition is that strangers can behave as they like, while still sharing the same space together. If we are to consider further why this is preferred, it is contingent upon the disposition of elements and human beings that come together to characterize the place.

Natural elements

As long as we are on earth, established laws of physics cannot simply be cancelled or ignored. The intrinsic behaviors of natural elements therefore form a microclimate, influencing each space's quality, whether interior or exterior. For example,

a height difference between spaces invites heated air, produced by rhythms of direct sunshine and human activity, to rise from lower to upper parts; without any height difference, no movement occurs. Openings at the top exhaust heated air; low openings provide fresh air from outside. This mechanism of gravity ventilation which utilizes nature's basic features and strengths is not particularly special on its own, but once one really begins to imagine this behavior of air and heat, the form of space can be perceived as ecologically entwined with the flux of natural elements. If we optimize this kind of performance, it is not inconceivable that buildings resemble living, breathing creatures. In this kind of space, science turns into poetics. Architecture becomes the framework in which this can occur.

Buildings

In places where certain attributes of a building repeat and accumulate, a streetscape order is produced. For such an appearance to emerge, these places were not planned, nor were there original blueprints. Rather, their forms seem to have stabilized after many years. Enduring repetition over time, both the unique elements and the overall compositions of built form could only survive through a process of continuous trial and error. Take Venice, for instance. Individual buildings, though far from homogenous, share a certain set of characteristics dealing with their close relationship to water and boats. At the same time, they exhibit unique differences within a particular range, without veering far from their shared vocabulary; divergence in this way demonstrates both a retroactive quality as well as an inherent flexibility. This range, which can be likened to the gravitational pull of an axis –the architectural language—could be called the behavior of buildings. As discussed previously, this is not cultivated within a short period of time, but rather may require generations. Furthermore, manifest in an individual building and operating at different scales are the behaviors of human beings and natural elements. They introduce the existence of micro-flux—the movement of things smaller than the building itself—further defining the quality of architectural space. On the other hand, the behavior of even a single building must necessarily be framed in its larger context, at an urban scale, where accumulations of buildings with individual components can be compared and contrasted. Thus the existence of individual buildings can be created as a potentially important influence on the quality of collective space. Following this, a form that properly supports a building's behavior overlaps with its existing conditions, and it becomes possible for that building to repeat and accumulate. These conditions, which equally affect any type of building, allow for groups of buildings with shared aspects to be collected. For example, in the absence of certain infrastructure—roadways, water and electricity supply, and so on—buildings have no ability to repeat, accumulate, and thrive. In another case, buildings built on a slope can be grouped insofar as they share the issue of adapting to topographical features. In locales dominated by sunshine, rain, or snow, features appear in the buildings that adapt admirably to the climatic conditions—conditions which transcend social differences and favor no individual site.

5. Interplay between different behaviors

Until now, discussions on the different categories of behavior have been kept as distinct from one another as possible. In reality, however, there is between them constant commingling—a so-called ecosystem of behavior. Within this, architecture becomes the central node, capably synthesizing and facilitating these disparate behaviors. Architecture makes it possible for daily spatial practice to be properly situated in a much broader context. That which is usually considered solely the realm of social relationships is expanded to include nature and the whole of the cosmos, resulting in a liberation of the human imagination. By way of several examples, we would like to discuss the possibility of an architectural behaviorology that calls attention especially to the interdependence of behaviors at different scales—with architecture as its site and medium.

In winter, human beings are drawn to warm places where sunlight reaches; likewise in summertime, we seek out cool places in the shade. The same could be said about certain activities favoring either light-filled or darkened spaces. It is within these spatial settings that natural, enduring human tendencies exist --enabled by a building's configuration of walls, roofs and openings, which in turn invite the natural elements inside.

Rainwater on a roof flows from down from higher points, following gravity. A roof's pitch follows a straightforward and predetermined natural rule. But why is this? When waterproofing techniques were limited, a single roof's successful reaction to the problem invited repetition, eventually creating a particular roof type throughout the settlement. And even today, in areas where houses share the collective burden of winters with heavy snowfalls, roofs resembling one another create a unity of landscape. The form, refined by its adaptation to the natural elements, is shared by different houses as a common architectural language.

Or, if there is a street, buildings tend to line up and repeat alongside, taking advantage of the fresh air and sunlight it provides. Often, a window's condition of operability defines its size. Along a street, therefore, if there are similar-sized windows, they contain the collective behavior of human beings and other surrounding elements. The windows' repetition can give a certain unity to the entire streetscape, even if their host buildings are different sizes, composed of different materials, or constructed in different eras. Thus, architectural language is a kind of intelligence which creates interplay between divergent behaviors.

Up until now, the discussion touching upon nature has been largely based on physics, but here the conversation considers the more motile objects of the natural realm. In the case of trees, whether plum or cherry, gingko or maple, the blossoming of their flowers and the changing color of their leaves could be framed in terms of the behavior of nature with a one-year cycle. Through this seasonal change, people are coaxed outside for the event, individually and of their own volition. Then, a food stall or an outdoor market appears, and out of nowhere people have unexpectedly gathered, a spiraling of human activity. Through the arrangements of these installations, an animated public space emerges. This situation, where different behaviors synchronize and overlap, is a uniquely Japanese public space, and ably competes with the vibrancy of the western-style plaza. Once, we encountered such a scene where an old woman, despite being hampered by a leg injury, walked with the support of family members slowly towards the trees of a plum grove, fully in bloom. We imagined that this woman, who might rarely leave home due to its inconvenience, was encouraged by this moment that the beauty of the plum blossoms gave her courage, while her steps, despite the pain, led her forward. She had come together with others who had also arrived to witness this once-a-year event. Through space and through sentiment, they are all connected indirectly by the plum grove. After the flowers disappear and the people return to their homes, this shared space too is gone; only the trees remain. But during that brief period of time, it is without a doubt that the different rhythms of lives, activities and cycles were synchronized. Behaviors overlap to create a kind of synergy, a subtle intelligence which can be clearly recognized even if there are no buildings. When those embodied rhythms emit a certain suitable frequency—and correspond to a suitable material or location—they can begin to form the shape of buildings and of urban space.

6. Atelier Bow-Wow as seen through behaviorology

The previous examination of behaviorology has aimed to clarify a type of intelligence that is composed of an overlapping of different rhythms. This intelligence's analytical ability and transformability spreads, applying not only to buildings but

to all elements of landscape, urban space, and the built environment. Since it is embedded into collective, shared territories, it cannot be monopolized. By working with the question posed at the beginning of the discussion, a direction to proceed becomes apparent, through which more concrete concepts can now be situated. Under each of the following three concepts, we would like to reposition our previous works collected and documented in this book.

Void Metabolism and the Fourth-Generation House

As we are based in Tokyo, we have had the chance to design over twenty houses, many of which call into direct question the meaning of designing a single small house in the context of such a gigantic city. Over time, we began to think that we were assisting in the perpetual regeneration of the grain of the city through this particular kind of house design. In Tokyo, small houses, usually two or three floors high, cover the land surface almost infinitely, with small gardens or greenery inserted in the gaps between them. At a glance, this horizontal "city made of houses" may appear inefficient or stifling. In fact, it is a highly sustainable urban form which regenerates itself quite spontaneously: operating without public tax subsidies, here are privately owned properties, taking advantage of the comprehensive and established railway network. This city, a field of autonomous, self-regenerating grains, can be considered a type of Metabolism, though quite different in form and content from that which was popularized in 1960s architectural thought. At that time, Metabolists symbolized their concepts in terms of the composition of the vertical core—the bundling of lifelines surrounded by detachable capsules. With the benefit of hindsight, we can surmise that the architects of that time believed that the construction of the city would be carried out effectively through a concentration of power and capital. However, the reality of development in those residential areas mentioned above turned out quite differently. The regeneration of houses would revolve not around a core, but a void—the gap space between buildings —and would be propelled by the initiatives of individual families, rather than the accumulation of central capital. Further distinguished from the "Core Metabolism" of fifty years ago, it is within the framework of "Void Metabolism" that the practice of designing small houses in Tokyo's residential areas is a clearly perceivable housing behavior.

If the urban formula of Void Metabolism begins, say, with Tokyo's first suburban developments in the 1920s, then its oldest constituent parts are already ninety years old. Considering that the typical Japanese house has a twenty-six-year average lifespan, houses in these original areas have, in theory, regenerated twice over. Of course, there are differences in lifespan between individual houses, so today's situation can be said to include a mixture of the first, second, and third generations of building. By embedding a 26-year regeneration frequency within the residential area's timeline, we can begin to observe, according to generations, a variety of building behaviors. This ninety-year time period is especially significant considering the changes that have occurred in Japanese society. Political and economic conditions, building regulations, construction technique, not to mention changes to family structures and values—have all seen great change, and are reflected in the times of their construction. In most parts of Tokyo's urban landscape, this overlay of different time periods is fixed in the behavior of the houses, so that, even in buildings found side by side, there can be glaring generational differences. However, such an arrangement, lacking obvious order, is far from chaotic. In fact the houses we produce now cannot escape the position of being a part of the fourth generation, framed by the realities of Void Metabolism. What, therefore, should a "Fourth-Generation House" be?

To address this question, there must first be a critical reconsideration of the behaviors seen in the second- and third-generation houses built following World War II. It becomes important to confront and overcome the fact that modernization promoted a "pure" house made solely for its family members, that the introduction of prerequisite air conditioning eliminated opportunities to spend time in shaded or sheltered outdoor spaces, and that the inevitable "leftover" gaps produced between

adjacent homes were defined neither as urban space nor as living space. Unsurprisingly, a lackluster street presence is found throughout such suburban residential neighborhoods. In light of this, we raise three important conditions for the fourth-generation house: that interior spaces be inviting for those who are not members of the family; that quasi-exterior spaces be introduced in a positive manner, coaxing inhabitants out of their homes; and that the gap spaces between neighboring buildings be redefined. Nevertheless, proposals dealing with issues of this kind are possible because Tokyo has enjoyed a period of sixty years of essentially uninterrupted development. Ironically, it is only now that Tokyo is entering into a state of childhood, encountering its own intelligence.

Micro Public Space

Let's also consider the various artworks, installations and exhibitions in various cities worldwide. When you visit a place for the first time and are unsure how to immediately behave, you might observe your surroundings for a while, and gradually, you begin to form an understanding its rules. Then, tentatively, you enter into its circle: this experience can be quite thrilling, and if you happen to be accepted as "one of them"—despite being a stranger from a strange land—you feel very warm. This is a singular, irreplaceable social experience. To be sure, the act of gathering is a universal social behavior, but the methods may vary from culture to culture. And within the public space itself— the veritable stage of gathering—many distinct characteristics can also be recognized. A certain behavior is thus shared by others participating in that same place, melting social distinctions and psychological barriers. If you want to experience the warmth of a group, or empathize with others you don't know, it is first necessary to share a time, a location, and a certain sophistication of behavior suitable for the occasion. Take, for example, the language of the plaza as it is often implemented in modern urban planning. In the case where bureaucratic concerns take the foreground, such open spaces may lack the content to nurture a diverse range of behaviors and, without activity or pressure of any kind, this plaza cannot become anything more than a formal symbol. On the contrary, though they may be inferior in terms of size, facilities or formal design, lively public spaces can be encountered in old city centers, where the local inhabitants' intricate patterns of behavior endure. In other words, if it is truly public, it must thrive out of necessity on the behavior of its users, lest it become an unused, vacant space in the city.

Through our participation in international art festivals around the world, we have used this framework to observe many places which encourage the gathering of people in public space. We have witnessed different relationships between local customs and their supporting physical environment, and studied their orientations, distances, sizes and arrangements. Then, from this research, we have utilized rhetorical devices such as deformation, shifting and replacement to produce new but familiar behaviors. With this ongoing series of projects, we continue to explore the larger concept of Micro Public Space to imagine the various spirals, eddies and flows where people converge and disperse. They appear in various forms—artificial topography, small buildings, mobile structures, large furniture— but they all share the characteristic of a defamiliarized social space, embedded in the fabric of existing buildings and furniture. Daily life is thus reframed, as if by a film or theater director, into something light-hearted, sweet, or humorously self-evident.

Environmental Unit, Generational Typology and Flux Management

Alongside the aforementioned activities, Atelier Bow-Wow have worked on a number of urban research projects, both in Japan (Tokyo, Tsukuba, Mito, and Kanazawa) as well as abroad (Paris, Bangkok, and Chongqing, among others), from whose contents and methodologies several concepts have emerged. First, the concept of the "Environmental Unit" has been employed to make sense of urban spatial practices through the observation of hybrid buildings (*Made in Tokyo*) or tiny buildings (*Pet Architecture*). This concept tries to discover the independent orders originating from the urban

environment, which are anchored by single elemental units or buildings. Next, "Generational Typology" has been discussed, in particular regarding our investigation of the transformation of *machiya* (townhouse) types found in Kanazawa. This research investigated the transformation of individual machiyas under the various pressures of modernization, from its original formula established in the Edo period until present-day. Through these transformations, the behavior of machiya was clarified in terms of several distinct, generational typologies. Finally, "Flux Management" explores the behavior of large-scale elements flowing throughout the city—such as water, fire, heat, automobile traffic, and garbage—and how they intervene in the city's administration. During the twentieth century, the population explosion in Tokyo produced many types of potential flux in the urban environment, in turn producing potential damage to the quality of daily life. Recognition of this flux has given rise to various, large-scale socio-infrastructural projects—dams, water detention reservoirs, traffic superstructures, and so on. These are real, fully functioning spaces, whose flux content is nevertheless beholden to following the principles of nature of each flux, albeit at a scale which extends far beyond any single building. If we trace backwards this process of constructing these huge structures in the city, it's possible to make suitable proposals that can reunify urban spaces, in keeping with their organic order.

7. Possibilities for behaviorology

We would like to conclude by revealing the continuing possibilities of behaviorology in relation to the questions raised at the beginning of the discussion. As stated previously, behaviorology can be applied not only to the human beings, but also to natural elements and to buildings. It is a means to organically integrate the built environment across disparate scales: from furniture to architecture, to structures of civil engineering, to the landscape and urban planning. It positions projects within an ecosystem of behaviors as elements which participate in spatial production, forming a larger ecological critique on the separation of the academic, professional and industrial spheres.

It is necessary to introduce the idea of timescale in the observation of behavior. This reveals the uniqueness of the rhythms embedded in the various objects that surround our daily life. The coordination of these different rhythms can result in various encounters: the past with the future, and the social with the natural, building up a spatial and temporal framework for positioning ourselves in the here and now. Such an overlay resembles the temporal arts, such as theater and music, and relativizes compositional concepts from the twentieth century, influenced largely by the visual arts of painting and sculpture.

Behaviors gradually increase in precision and sophistication through repetitive responses to certain conditions. This intelligence, growing through a learning process embedded in a feedback loop, cannot be acquired by any single individual but rather links people living together in an area with the buildings they make, encompassed in the larger social and cultural sphere. In this way architecture stores the intellectual capacity of human beings throughout history. Through the frame of behaviorology, the existence of architecture might be rediscovered for its generosity, as it stands alongside human beings and is mindful of our individual differences.

Behaviorology brings about an immediate shift in subjectivity, inviting many different elements together and calling into question who or what may be the main protagonist of a space. Through this ecological approach, our imagination follows the principles of nature and experiences space from a variety of perspectives. When one is surrounded by and synchronized to the livable rhythms embedded in different behaviors—there is no experience quite so delightful.

On actor-network theory

A few clarifications

Von Bruno Latour

I.

Exploring the properties of actor-networks is the task that the Paris group of science and technology studies has set itself to tackle since the beginning of the 1980s (Callon/Law/Rip 1986). However, this theory has often been misunderstood and hence much abused. In this paper I would like to list some of the interesting properties of networks and explain some of the misunderstandings that have arisen. I will not concern myself here with the quantitative studies, especially the so-called "co-word analysis", since they are themselves misunderstood because of the difficulty of exactly grasping the social theory and quaint ontology entailed by actor-network (but see Callon/Courtial/Lavergne 1989a; b).

Three misunderstandings are due to common usages of the word network itself and the connotations they imply.

The first mistake would be to give it a common *technical* meaning in the sense of a sewage, or train, or subway, or telephone "network". Recent technologies often have the character of a network, that is, of exclusively related yet very distant elements with the circulation between nodes being made compulsory through a set of rigorous paths giving to a few nodes a strategic character. Nothing is more intensely connected, more distant, more compulsory, and more strategically organized than a computer network. Such is not however the basic metaphor of an actor-network. A technical network in the engineer's sense is only one of the possible *final* and *stabilized* states of an actor-network. An actor-network may lack all the characteristics of a technical network — it may be local, it may have no compulsory paths, no strategically positioned nodes. Tom Hughes's "networks of power" (1983), to give a historical example, are actor-networks at the beginning of the story, and only some of their stabilized elements end up being networks in the engineer's sense, that is the electrical grid. Even at this later stage the engineering definition of networks is still a partial projection of an actor-network.

The second misunderstanding is easy to lift: the actor-network theory (hence ANT) has very little to do with the study of social networks. These studies, no matter how interesting, concern themselves with the *social* relations of *individual human* actors — their frequency, distribution, homogeneity, proximity. It was devised as a reaction to the often too global concepts like those of institutions, organizations, states and nations, adding to them a more realistic and smaller set of associations. Although ANT shares this distrust for such vague all-encompassing sociological terms, it also aims at describing the very nature of societies. But to do so it does not limit itself to human individual actors, but extends the word actor — or actant — to *non-human*, *non-individual* entities. Whereas social network adds information on the relations of humans in a social and natural world which is left untouched by the analysis, ANT aims at accounting for the very essence of societies and natures. It does not wish to add social networks to social theory, but to rebuild social theory out of networks. It is as much an ontology or a metaphysics as a sociology (Mol/Law 1994). Social networks

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will of course be included in the description, but they will have no privilege nor prominence (and very few of their quantitative tools have been deemed reusable).

Why then use the word network, since it is open to such misunderstandings? The use of the word comes from Diderot. The word "réseau" was used from the beginning by Diderot to describe matter and bodies in order to avoid the Cartesian divide between matter and spirit. Thus, the word has had a strong ontological component from the beginning (Anderson 1990). Put too simply, ANT is a change of metaphors to describe essences: instead of surfaces one gets filaments (or rhyzomes in Deleuze's parlance Deleuze/Guattari 1980)). More precisely it is a change of topology. Instead of thinking in terms of surfaces — two dimensions — or spheres — three dimensions — one is asked to think in terms of nodes that have *as many dimensions* as they have connections. As a first approximation, ANT claims that modern societies cannot be described without recognizing them as having a fibrous, thread-like, wiry, stringy, ropy, capillary character that is never captured by the notions of levels, layers, territories, spheres, categories, structures, systems. It aims at explaining the *effects* accounted for by those traditional words without having to buy the ontology, topology and politics that go with them. ANT has been developed by students of science and technology, and its claim is that it is utterly impossible to understand what holds society together without reinjecting in its fabric the facts manufactured by natural and social sciences and the artefacts designed by engineers. As a second approximation, ANT is thus the claim that the only way to achieve this reinjection of things into our understanding of social fabrics is through a network-like ontology and social theory.

To remain at this very intuitive level, ANT is a simple material resistance argument. Strength does not come from concentration, purity and unity, but from dissemination, heterogeneity and the careful plaiting of weak ties. This feeling that resistance, obduracy and sturdiness are more easily achieved through netting, lacing, weaving, twisting of ties that are weak by themselves, and that each tie, no matter how strong, is itself woven out of still weaker threads, permeates for instance Foucault's analysis of micro-powers as well as recent sociology of technology. But the less intuitive philosophical basis for accepting ANT is a background/foreground reversal: instead of starting from universal laws — social or natural — and taking local contingencies as so many queer particularities that should be either eliminated or protected, it starts from irreducible, incommensurable, unconnected localities which then, at a great price, sometimes end into provisionally commensurable connections. Through this foreground/background reversal ANT has some affinity with the order out of disorder or chaos philosophy (Serres 1983; Prigogine/Stengers 1979) and many practical links with ethnomethodology (Garfinkel and Lynch's principle in Lynch 1985). Universality or order are not the rule but the exceptions that have to be accounted for. Loci, contingencies or clusters are more like archipelagos on a sea than like lakes dotting a solid land. Less metaphorically, whereas universalists have to *fill in* the whole surface either with order or with contingencies, ANT does not attempt to fill in what is *in between* local pockets of orders or *in between* the filaments relating these contingencies.

This is the most counter-intuitive aspect of ANT. Literally there is nothing but networks, there is nothing in between them, or, to use a metaphor from the history of physics, there is no aether in which networks should be immersed. In this sense ANT is a reductionist and relativist theory, but, as I shall demonstrate, this is the first necessary step towards an irreductionist and relationist ontology.

II.

ANT makes use of some of the simplest properties of nets and then adds to it an *actor* that does some *work*; the addition of such an ontological ingredient deeply modifies it. I will start out with the simplest properties common to all networks.

Far/close: the first advantage of thinking in terms of networks is that we get rid of "the tyranny of distance" or proximity. Elements which are close when disconnected may be infinitely remote when their connections are analyzed; conversely, elements which would appear as infinitely distant may be close when their connections are brought back into the picture. I can be one metre away from someone in the next telephone booth and nevertheless be more closely connected to my mother 6000 miles away; an Alaskan reindeer might be ten metres away from another one and they might nevertheless be cut off by a pipeline of 800 miles that makes their mating for ever impossible; my son may sit at school with a young arab of his age, but in spite of this close proximity in first grade they might drift apart in worlds that will become incommensurable later; a gas pipe may lie in the ground close to a cable television glass fiber and nearby a sewage pipe, and each of them will nevertheless continuously ignore the parallel worlds lying around them. The difficulty we have in defining all associations in terms of networks is due to the prevalence of geography. It seems obvious that we can oppose proximity and connections. However, geographical proximity is the result of a science — geography —, of a profession — geographers —, of a practice — mapping system, measuring, triangulating. Their definition of proximity and distance is useless for ANT — or it should be included as one type of connections, one type of networks, as we will see below. All definitions in terms of surface and territories come from our reading of maps drawn and filled in by geographers. Out of geographers and geography, "in between" their own networks, there is no such thing as a proximity or a distance which would not be defined by connectibility. The geographical notion is simply another connection to a grid defining a metrics and a scale (Jacob 1990). The notion of network helps us to lift the tyranny of geographers in defining space and offers us a notion which is neither social nor "real" space, but associations.

Small scale/large scale: the notion of network allows us to dissolve the micro-macro-distinction that has plagued social theory from its inception. The whole metaphor of scales going from the individual to the nation state, through family, extended kin, groups, institutions etc. is replaced by a metaphor of connections. A network is never *bigger* than another one, it is simply *longer* or *more intensely* connected. The small scale/large scale model has three features which have proven devastating for social theory: it is tied to an order relation that goes from top to bottom or from bottom to top — as if society really had a top and a bottom; it implies that an element "b" being macro-scale is of a different nature and should thus be studied differently from an element "a" which is micro-scale; it is utterly unable to follow how an element goes from being individual — a — to collective — b — and back.

The network notion implies a deeply different social theory: it has no a priori order relation; it is not tied to the axiological myth of a top and a bottom of society; it makes absolutely no assumption whether a specific locus is macro- or micro- and does not modify the tools to study element "a" or element "b"; thus, it has no difficulty in following the transformation of a poorly connected element into a highly connected one *and back*. The network notion is ideally suited to follow the change of scales, since it does not require the analyst to partition her world with any a priori scale. The scale, that is, the type, number and topography of connections, is left to the actors themselves.

The notion of network allows us to lift the tyranny of social theorists, to regain some margin of manoeuvres between the ingredients of society — its vertical space, its hierarchy, its layering, its macro-scale, its wholeness, its overarching character — and to see how these features are achieved and what stuff they are made of. Instead of having to choose between the local and the global view, the notion of network allows us to think of a global entity — a highly connected one — which nevertheless remains continuously local . . . Instead of opposing the individual level to the mass, or agency to structure, we simply follow how a given element becomes strategic through the number of connections it commands, and how it loses its importance when losing its connections.

Inside/outside: the notion of network allows us to get rid of a third spatial dimension after those of far/close and big/small. A surface has an inside and an outside separated by a boundary. A network is all boundary without inside and outside. The only question one may ask is whether or not a connection is established between two elements. The surface "in between" networks is either connected — but then the network is expanding — or non-existing. Literally, a network has no outside. It is not a foreground over a background, nor a crack onto a solid soil, it is like Deleuze's lightning rod that creates by the same stroke the background and the foreground (Deleuze 1968). The great economy of thinking allowed by the notion of network is that we are no longer obliged to fill in the space in between the connections — to use a computer metaphor, we do not need the little paint box familiar to MacPaint users to "fill in" the interspace. A network is a positive notion which does not need negativity to be understood. It has no shadow.

The notion of network, in its barest topological outline, already allows us to reshuffle spatial metaphors that have rendered the study of society-nature so difficult: close and far, up and down, local and global, inside and outside. They are replaced by associations and connections (which ANT does not have to qualify as being either social or natural or technical as I will show below). This is not to say that there is nothing like "macro" society or "outside" nature as ANT is often accused of, but that in order to obtain the *effects* of distance, proximity, hierarchies, connectedness, outsiderness and surfaces an enormous *supplementary* work has to be done (Latour 1996a). This work, however, is not captured by the topological notion of network, no matter how sophisticated we wish to make it. This is why ANT adds to the mathematical notion of network a completely foreign notion, that of actor. The new hybrid "actor-network" leads us away from mathematical properties into a world which has not yet been so neatly charted. To sketch these properties we should now move on from static and topological properties to dynamic and ontological ones.

III.

A network in mathematics or in engineering is something that is traced or inscribed by some other entity — the mathematician, the engineer. An actor-network is an entity that *does* the tracing and the inscribing. It is an ontological definition and not a piece of inert matter in the hands of others, especially of human planners or designers. It was in order to point out this essential feature that the word "actor" was added to it.

Now, the word actor has been open to the same misunderstanding as the word network. "Actor" in the Anglo-Saxon tradition is always a human intentional individual actor and is most often contrasted with mere "behaviour". If one adds this definition of an actor to the social definition of a network, then the bottom of misunderstanding is reached: an individual human — usually male — who wishes to grab power makes a

network of allies and extends his power — doing some "networking" or "liaising" as the Americans say ... Alas, this is the way ANT is most often represented, which is about as accurate as saying that the night sky is black because the astrophysicists have shown there is a big black hole in it. An "actor" in ANT is a semiotic definition — an actant —, that is something that acts or to which activity is granted by others. It implies *no* special motivation of *human individual* actors, nor of humans in general. An actant can literally be anything provided it is granted to be the source of an action. Although this point has been made over and over again, anthropocentrism and sociocentrism are so strong in social sciences (as well as in the critiques of social explanations) that each use of ANT has been construed as if it talked of a few superhumans longing for power and stopping at nothing to achieve their ruthless goals ... Even my own network study of Pasteur (Latour 1988a) — in spite of the lengthy ontological second part — has often been understood as a Madison Avenue version of science — which is unfair not only to my account but also to Madison Avenue ... If a criticism can be levelled at ANT it is, on the contrary, its complete indifference for providing a model of human competence. There is no model of (human) actor in ANT nor any basic list of competences that have to be set at the beginning, because the human, the self and the social actor of traditional social theory is not on its agenda.

So what is on its agenda? The attribution of human, unhuman, nonhuman, inhuman characteristics; the distribution of properties among these entities; the connections established between them; the circulation entailed by these attributions, distributions and connections; the transformation of those attributions, distributions and connections of the many elements that circulate, and of the few ways through which they are sent.

The difficulty of grasping ANT is that it has been made by the fusion of three hitherto unrelated strands of preoccupations:

— a semiotic definition of entity building;
— a methodological framework to record the heterogeneity of such a building;
— an ontological claim on the "networky" character of actants themselves.

ANT asserts that the limits of these three unrelated interests are solved when, and only when, they are fused into an integrated practice of study.

Semiotics is a necessary step in this venture, since when you bracket out the question of reference and that of the social conditions of productions — that is nature "out there" and society "up there" — what remains is, in a first approximation, meaning production, or discourse, or text. This is the major achievement of the sixties and of their "linguistic turn" or "semiotic turn". Instead of being means of communications between human actors and nature, meaning productions became the only important thing to study. Instead of being unproblematic, they became opaque. The task was no longer to make them more transparent, but to recognize and relish their thick, rich, layered and complex matter. Instead of being mere *intermediaries*, they had become *mediators*. From a means, meaning has been made an end in itself. For twenty years the best minds have been busy exploring all the consequences of this major turn away from the naïve model of communication. Their often structuralist interpretations have been dismantled, but what remains is a toolbox to study meaning productions. ANT sorts out from this toolbox what is useful to understand the construction of entities. The key point is that every entity, including the self, society, nature, every relation, every action, can be understood as a "choice" or a "selection" of finer and finer embranchments going from abstract structure — actants — to concrete ones — actors. The generative path that is thus retraced gives an extraordinary liberty of analysis compared

to the empoverished "social vocabulary" that was used earlier — and is now in fashion again. Of course the structural rendering of these choices — differences — and embranchments — dichotomies — are not kept by ANT, but essential traits of semiotics are kept. First, the *granting* of humanity to an individual actor, or the granting of collectivity, or the granting of anonymity, of a zoomorphic appearance, of amorphousness, of materiality, requires paying the *same semiotic price*. The effects will be different, the genres will be different, but not the *work* of attributing, imputing, distributing action, competences, performances and relations. Secondly, actors are not conceived as fixed entities but as flows, as circulating objects undergoing trials, and their stability, continuity, isotopy has to be obtained by other actions and other trials. Finally, what is kept from semiotics is the crucial practice to grant texts and discourses the ability to define also their context, their authors — in the text —, their readers — in fabula — and even their own demarcation and metalanguage. All the problems of the analyst are shifted to the "text itself" without ever being allowed to escape into the context (Greimas 1976). Down with interpretation! Down with the context! The slogans of the the 60s and 70s "everything is a text", "there is only discourse", "narratives exist by themselves", "we have no access to anything but accounts" are kept in ANT but saved from their ontological consequences. This salvation, however, does not come by falling back on the pre-deconstruction common sense — "after all, there is a social context up there and a nature out there" — but by extending the semiotic turn to this famous nature and this famous context it has bracketed out in the first place.

A major transformation of these slogans occurred when semiotics was turned to scientific and technical discourse by ANT — and especially to scientific texts. As long as one studied fictions, myths, popular cultures, fashions, religions, political discourse, one could hold to the "semiotic turn" and take them as so many "texts". Scholars did not seriously believe in them anyway, and thus the intellectual distance and scepticism was easy to achieve while the double treasury of "scientism" and "socialism" was kept intact in their heart. But what about scientific truth and material efficiency? What about the reference "out there" in hard scientific texts? This was the real test for semiotics, and although it passed the trial a price had to be payed. In the practice of ANT semiotics was extended to define a completely empty frame that enabled to follow any assemblage of heterogeneous entities — including now the "natural" entities of science and the "material" entities of technology. This is the second strand of ANT: it is a *method* to describe the deployment of associations like semiotics; it is a method to describe the generative path of any narration. It does not say anything about the shape of entities and actions, but only what the recording device should be that would allow entities to be described in all their details. ANT places the burden of theory on the *recording*, not on the specific shape that is recorded. When it says that actors may be human or unhuman, that they are infinitely pliable, heterogeneous, that they are free associationists, know no differences of scale, that there is no inertia, no order, that they build their own temporality, this does not qualify any real *observed* actor, but is the necessary condition for the observation and the recording of actors to be possible. Instead of constantly predicting how an actor should behave and which associations are allowed a priori, ANT makes no assumption at all, and in order to remain uncommitted it needs to set its instrument by insisting on infinite pliability and absolute freedom. In itself ANT is *not* a theory of action, no more than cartography is a theory on the shape of coast lines and deep sea ridges; it just qualifies what the observer should suppose in order for the coast lines to be recorded in their fine fractal patterns. Any shape is possible provided it is obsessively coded as longitude and

latitude. Similarly, any association is possible provided it is obsessively coded as a heterogeneous association through translations. It is more an infralanguage than a metalanguage. It is even less than a descriptive vocabulary; it simply opens, *against* all a priori reductions, the possibility of describing irreductions (Latour 1988a, part II). ANT is not merely empiricist though, since in order to define such an irreducible space in which to deploy entities sturdy theoretical commitments have to be made and a strong polemical stance has to be taken, so as to forbid the analyst to dictate actors what they should do. Such a distribution of a strong theory for the recording frame and no middle range theory for the the description is another source of many misunderstandings, since ANT is accused of either being dogmatic or of providing mere descriptions. For the same reason it is also accused of claiming that actors are "really" infinitely pliable and free or, inversely, of not telling what a human actor really is after (Lee/Brown 1994).

The first two strands — the semiotic and the methodological one — by themselves will be open to criticism. The first because there is no way to consider that bracketing out social context and reference solves the problem of meaning — in spite of the now dated claims of the swinging seventies —, and the second because merely deploying shapes of associations might be a worthwhile descriptive task but does not offer any explanation. It is only when a third strand is added to those two and ontological claims on networks are made that ANT escapes criticism. This move, however, is so devious that it has escaped the attention of many users of ANT. Which is a pity, since once it is made, ANT loses its radical character and soon appears commensensical enough.

The weakness of semiotics has always been to consider meaning production away from what the nature of entities really is; when semiotics is turned to nature however and unhuman entities are allowed to enter into the picture, it soon appears that the words "discourse" or "meaning" may be dropped altogether without any danger of going back to naïve realism or naïve naturalism. It is only because semioticians studied texts — and literary ones at that — instead of things that they felt obliged to limit themselves to "meaning". In effect they scientistically believed in the existence of things in addition to meaning (not mentioning their belief in the existence of a good old social context whenever it suited them). But a semiotics of things is easy, one simply has to drop the meaning bit from semiotics ...

If one now translates semiotics by path-building or order-making or creation of directions, one does not have to specify if it is language or objects one is analyzing. Such a move gives a new continuity to practices that were deemed different when one dealt with language and "symbols", or with skills, work and matter. This move can be said either to elevate things to the dignity of texts or to elevate texts to the ontological status of things. What really matters is that it is an elevation and not a reduction, and that the new hybrid status gives *to all entities* both the action, variety and circulating existence recognized in the study of textual characters *and* the reality, solidity, externality that was recognized in things "out of" our representations. What is lost is the absolute distinction between representation and things — but this is exactly what ANT wishes to redistribute through what I have called a counter-copernican revolution.

Once settled this first solution — extending semiotics to things instead of limiting it to meaning —, the second difficulty falls with it — building an empty methodological frame to register description. Actor-networks do connect, and by connecting with one another provide an explanation of themselves, the only one there is for ANT. What is an explanation? The attachment of a set of practices that control or interfere in one another. No explanation is stronger or more powerful than providing connections among unrelated elements or showing how one element holds many others. This is not

a property that is *distinct* from networks but one of their essential properties (Latour 1988b). They become more or less explanable as they go and depending on what they do to one another. Actors are cleaning up their own mess, so to speak. Once you grant them everything, they also give you back the explanatory powers you abandoned. The very divide between description and explanation, hows and whys, blind empiricism and high theorizing is as meaningless for ANT as the difference between gravitation and space in relativity theory. Each network, by growing, "binds" the explanatory resources around it, and there is no way they can be detached from its growth. One does not jump outside a network to add an explanation — a cause, a factor, a set of factors, a series of co-occurences; one simply *extends* the network further. Every network surrounds itself with its own frame of reference, its own definition of growth, of refering, of framing, of explaining. In this process the frame of reference of the analyst does not disappear more than the physicist's in Einstein's world; on the contrary, at last it is able to extend itself, but at a price: the frame becomes, as it does in General Relativity, "a mollusc of reference" instead of a detached Galilean frame, and each account has to be recalculated by the ANT equivalent of a Lorentz transformation (Latour 1988c). There is no way to provide an explanation if the network does not extend itself. This is not in contradiction with the scientific task of providing explanation and causality, since we learned from the very studies of hard sciences that no explanation of any scientific phenomenon and no causality could be provided without extending the network itself. By tying the explanation to the network itself ANT does not abandon the goal of science, since it shows that this goal has never been achieved, at least not through the epistemological myth of explanation. ANT can't deprive itself of a resource it shows no one has ever had in the first place. Explanation is ex-plicated, that is unfolded, like gravity in Einstein's curved space, it is still there as an effect, but it is now indistinguishable from the description, the deployment of the net.

This relativistic position — but one should prefer the less loaded term of relationist — solves two other problems: that of historicity and that of reflexivity.

The pre-relativist debate between providing an explanation and "simply" documenting the historical circumstances falls apart: there is no difference between explaining and telling how a network surrounds itself with new resources; if it "escapes sociohistorical contingencies", as critics often argue, then this simply means that other, longer lasting resources have been garnered to stay around — the etymology of circumstances. Hughes's networks of power grow (Hughes 1983), and by their very growth they become more and more of an explanation of themselves; you do not need an explanation floating over them *in addition* to their historical growth; Braudel's networks and world economics grow, and they are what the "big causes" are made of. You do not need to add to them Capitalism or *Zeitgeist* except as another summary, another punctualisation of the networks themselves. Either the cause designates a body of practices which is tied to the network under description — and this is what growth of network means —, or it is not related, and then it is just a word added to the description, literally it is the *word* "cause". In this sense, ANT gives history its legitimate place — which is not the place prudent historians like to sit on, as safely away as possible from ontological questions. There is nothing better, sturdier than a circumstancial description of networks. "It just happens to be this way".

But such a summary would be construed as historicism if it were not understood as a definition of the things themselves. The debate between historicism and explanation or theory was not solvable as long as there was, on the one hand, a history of people, of contingencies, of what is "in time" and, on the other hand, a theory or a science of

what is timeless, eternal, necessary. For ANT there is science only of the contingent, as of necessity it is locally achieved only through the growth of a network. If there is also a history of things, then the debate between description and ex-planation, or historicity and theory, is entirely dissolved. For ANT this is not the proof of the weakness of its explanatory powers, since describing or accounting for a network is what an explanation or an explication is and what has always been the case in the so-called hard sciences — or more exactly "progressively hardened sciences" (Latour 1996b).

Although not the main goal of ANT, reflexivity is added as a bonus once the frames of reference are granted back to the actors — and once the actors are granted back the possibility of crossing the sacred dividing line between things and representations (Ashmore 1989). Reflexivity is seen as a problem in relativist theory, because it appears that either the observer requests a status it denies to others, or it is as silent as all the others to which any privileged status is denied. This "problem" falls, however, when the epistemological myth of an outside observer providing an explanation in addition to "mere description" disappears. There is no longer any privilege — but there has never been any need for it either. The observer — whatever it is — finds itself on a par with all the other frames of reference. It is not left to despair or navel-gazing, since the absence of privileged status has never limited the expansion and intelligence of any actor. World builder among world builders, it does not see a dramatic limit on knowledge in its abandonment of Galilean frames, but only resources. To extend from one frame of reference to the next it has to work and pay the price like any other actor. In order to explain, to account, to observe, to prove, to argue, to dominate and to see it has to move around and work (I should say it has to "network"). No privilege also means no a priori limits on knowledge. If actors are able to account for others, so can it. If actors can't, it might still try. History, risks and ventures are also in the observers' own network building. Such is ANT's solution to reflexivity (Stengers 1993).

Reflexivity is not a "problem", a stumbling block along the path to knowledge, the prison in which all enterprises would be locked, it is the land of opportunity at last opened to actors which are primus inter pares, or strive for parity or primacy like any other. Of course reusable metalangage is abandoned, but this is not giving up much, since observers who displayed their rich metalanguage were usally small points limited to very specific loci — campuses, studios, corporate rooms. The price ANT pays to move from one locus to the next is that there are as many metalanguages as there are frames of reference — the only metalanguage required (see above strand 2) being more adequately called an *infralanguage* which has to be poor, limited, short and simple — the equivalent of a Lorentz transformation being called "translation" in ANT (Latour 1988c). This infralanguage is enough to move from one net to the other, and the specific explication will always be a one-shot account exclusively tailored to the problem at hand (Lynch's principle, Callon's "disposable explanations", Serres's "cross over between explanandum and explanans" (Serres 1995)). If it is more generally applicable, it means that it is riding over a network that expands itself.

This solution becomes commonsense once it is accepted that an account or an explication or a proof is always added to the world; that it does not subtract anything from the world. Reflexivists as well as their pre-relativist enemies dream of subtracting knowledge from the things in themselves. ANT keeps adding things to the world, and its selection principle is no longer whether or not there is a fit between account and reality — this dual illusion has been dissolved away —, but whether or not one travels from a net to another. No metalanguage allows you to do this travel. By abandoning the dreams of epistemology ANT is not reduced to moral relativism, but gets back a

stronger deontological commitment: either an account leads you to all the other accounts — and it is good —, or it constantly interrupts the movement, letting frames of reference distant and foreign — and it is bad. Either it multiplies the mediating points between any two elements — and it is good —, or it deletes and conflates mediators — and it is bad. Either it is reductionist — and that's bad news —, or irreductionist — and that's the highest ethical standard for ANT. We will see that this touchstone is much more discriminating than the quest for epistemological purity, or for foundations, or for moral norms. Demarcation is in fact an enemy of differentiation.

Building on the semiotic turn, ANT first brackets out society and nature to consider only meaning-productions; then, breaking with the limits of semiotics without losing its toolbox, it grants activity to the semiotic actors turning them into new ontological hybrids, world making entities; by doing such a counter-copernican revolution it builds a completely empty frame for describing how any entity builds its world; finally, it retains from the descriptive project only very few terms — its infralanguage — which are just enough to sail in between frames of reference, and grants back to the actors themselves the ability to build precise accounts of one another by the very way they behave; the goal of building an overarching explanation — that is, for ANT, a centre of calculation that would hold or replace or punctuate all the others — is displaced by the search for ex-plications, that is for the deployment of as many elements as possible accounted for through as many metalanguages as possible.

IV.

Now that the basic topological properties of networks have been sketched — second section — and that the basic ontological features of actors have been outlined — section above —, there is no difficulty in seeing that ANT is not about *traced* networks, but about a network-*tracing* activity. As I said above, there is not a net and an actor laying down the net, but there is an actor whose definition of the world outlines, traces, delineates, describes, files, lists, records, marks or tags a trajectory that is called a network. No net exists independently of the very act of tracing it, and no tracing is done by an actor exterior to the net. A network is not a thing, but the recorded movement of a thing. The questions ANT addresses now have changed. It is no longer whether a net is a representation or a thing, a part of society or a part of discourse or a part of nature, but what moves and how this movement is recorded.

We cannot say that what moves *inside* networks are pieces of information, genes, cars, bytes, salutations, words, forces, opinions, claims, bodies, energy etc., since ANT also wants to reconstruct nets before there is any distinction between what circulates inside and what keeps them on track, so to speak, from the outside. Again, as I said at the beginning, the technical metaphor of networks is a latecomer for ANT and does not capture the tracing activity. No, what circulates has to be defined like the circulating object in the semiotics of texts — especially scientific texts (Bastide 1990). It is defined by the competence it is endowed with, the trials it undergoes, the performances it is allowed to display, the associations it is made to bear upon, the sanctions it receives, the background in which it is circulating etc. Its isotopy — that is its persistence in time and space — is not a property of its essence, but the result of the decisions taken through the narrative programmes and the narrative paths.

However, such a classic definition would limit ANT to the world of text and discourse. What happens when a circulating object leaves the boundary of a text? The traditional answer is that there is a yawning gap in between the text and the context. At the interface a dramatic trial is supposed to abruptly intervene through which the

circulating object is assessed either by checking its referential fit or its social interest. Not so for ANT, which does not believe in this distinction, since it has extended meaning productions to all productions. For ANT the gap is no more than a slight bump along the net; the yawn is an artefact caused by a previous divide between nature, society and discourse. For ANT on the contrary, there is a continuity, a multiplicity of plugs between the circulating objects in the text, the claims outside the text in the "social", and what the actants themselves really do in "nature". The circulating object goes on circulating and goes on getting its isotopy from what other actors do to it. "Society" has the same net-like properties as have texts, and so has "nature". But it would be more accurate for ANT to say that these three categories are arbitrary cutting points on a continuous tracing of action, and still more accurate to show how these categories themselves are part of the many trials and events and resources that are used along the paths to attribute "textuality" or "sociality" or "naturality" to this or that actor. They are part of what is distributed — not part of what makes the distribution.

There is no off-the-shelf word to describe this common movement. To say that it is a generalized narrative path would immediately mean that texts are extended to everything; to say that it is a force or an energy or a gene or a culture-gene would mean that everything would be naturalized, including society and discourse; to say that it is a social interest, a social action or labour would extend society to nature and to texts. It was to get out of this essential difficulty that ANT played with a generalized symmetry (Callon 1986) and made a principle of using whichever words are connoted in one of the former realms to describe the others, thus showing the continuity of networks and the complete disregard for the artefactual gaps introduced by pre-relativist arguments. However, this solution is rather tricky, since it may combine all the misunderstandings — and this is indeed what happened to ANT, readers and users alike saying *at once* that it is a social constructivist argument, the return of naturalism, or a typically French belief in the overall extension of texts ... Which of course it is in a sense, but only insofar as ANT is the simultaneous rejection of natural*isation*, social*isation* and textual*isation*. ANT claims that these "(x)-isations" have to be dissolved all at once and that the job is not done better if one of them gains hegemony or if the three are carefully circumscribed. All (x)-isations are the filling in of what is "in between" the networks; and which one is chosen or rejected makes no practical difference, since nets have no "in between" to be filled in.

If choosing words for the network-tracing activity has to be done, *quasi-objects* (Serres 1987) or *tokens* might be the best candidates so far. It is crucial for the definition of the term that what circulates and what makes the circulation be both co-determined and transformed. A ball going from hand to hand is a poor example of a quasi-object, since, although it does trace the collective and although the playing team would not exist without the moving token, the latter is not modified by the passings. Conversely, what I called the first principle of science studies (Latour 1987) — that a claim is in the hands of others — is equally an approximation, since it entails human locutors endowed with hands and mouths who pass a claim without themselves undergoing dramatic changes. As a rule, a quasi-object should be thought of as a moving actant that transforms those who do the moving, because they transform the moving object. When the token remains stable or when the movers are kept intact, these are *exceptional* circumstances which have to be accounted for. This definition of what is the rule and what are the exceptions would be enough to tell ANT from all models of communications that, on the contrary, begin with well defined movers and moving objects and view obstacles to exchanges as so many exceptions to be explained. But another feature forbids any confusion of ANT with human-centered, or language-centered, or praxis-centered models.

As a rule, what is doing the moving and what is moved have no specific homogeneous *morphism*. They can be anthropo-morphic, but also zoo-morphic, physi-morphic, logo-morphic, techno-morphic, ideo-morphic, that is "(x)-morphic". It might happen that a generative path has limited actants to a homogeneous repertoire of humans or of mechanism or of signs or of ideas or of collective social entities, but these are exceptions which should be accounted for (Latour 1996c).

ANT is a powerful tool to destroy spheres and domains, to regain the sense of heterogeneity, and to bring interobjectivity back into the centre of attention (Latour 1994). Yet it is an extremely bad tool for differentiating associations. It gives a black and white picture, not a coloured and contrasted one. Thus it is necessary, after having traced the actor-networks, to specify the types of trajectories that are obtained by highly different mediations. This is a different task, and the one that will make ANT scholars busy for a number of years to come.

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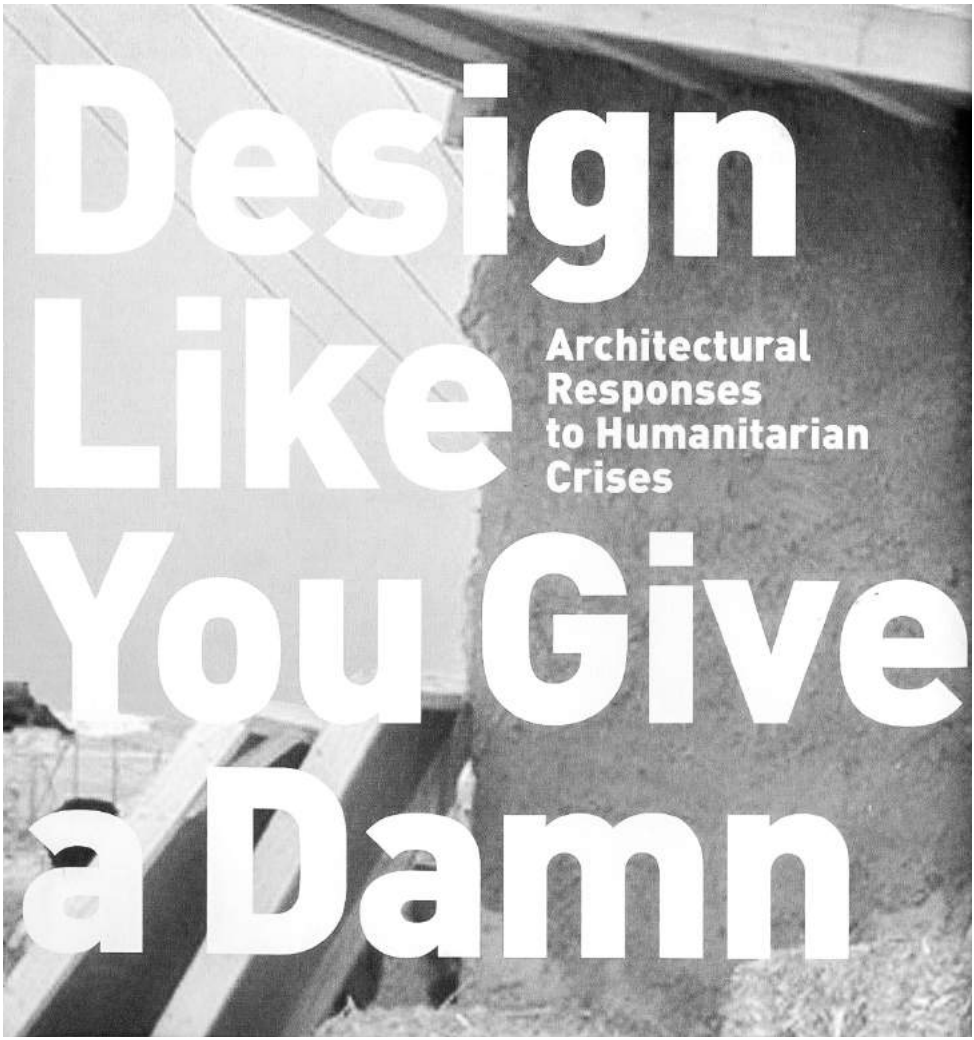

Design Like You Give a Damn
Architectural Responses to Humanitarian Crises

100 Years of Humanitarian Design

Kate Stohr

At 5:18 in the morning on April 18, 1906, the earth heaved beneath San Francisco, California.

The earthquake lasted for less than a minute, shearing façades off buildings, ripping houses from their foundations, and opening a rift in the ground 270 miles (435 km) long and up to 21 feet (6.4 m) deep. "It was as if the earth was slipping gently from under our feet," wrote one survivor. "Ahead of me a great cornice crushed a man as if he were a maggot."[1]

But if damage from the earthquake was extensive, the fires that followed were catastrophic. With its rows of closely spaced wooden Victorian homes and unreinforced brick buildings, San Francisco at the turn of the century was a tinderbox awaiting a match. The fires raged for three days, charring more than 500 blocks—nearly a quarter of the city. By the time rescuers were able to sift through the cinders, more than a quarter of a million people were left homeless.[2] Although the official death count totaled 700, it is now estimated that the earthquake and fires claimed between 1,500 and 3,000 lives.[3]

San Francisco at the turn of the century was in every sense a modern city: it had telegraph lines and cable cars, a mix of ethnic groups, and a tremendous disparity in wealth. The earthquake marked one of the first major disasters of the industrialized age, and many of the housing strategies employed by nascent relief agencies and the Army Corps of Engineers would later be adopted by today's relief and development agencies—strategies such as micro-credit, appropriate technology, and sweat equity. Yet perhaps the most intriguing outcome of the relief effort was the innovative marriage of policy and design that led to the construction of thousands of small wooden cottages that found their way into nearly every pocket of the city.

In the immediate aftermath of the earthquake and fires, the US Army, a citizens' committee made up of 50 prominent San Franciscans, and the American Red Cross, which had been established only 25 years before, were the first and primary agencies to respond. Survivors who had the means either left the city or roomed with friends or relatives outside of the burned district. Those who remained were those with little alternative, primarily the working poor and the destitute.

Initially the Army, the American Red Cross, and volunteers provided tents. But as aid workers and officials shifted their focus from relief to recovery and reconstruction, a combination of grants and loans were given to middle-class families who owned land (or could afford to purchase land) and who could demonstrate credit-worthiness to support the building of permanent housing in the burned district.[4]

However, more than a month after the disaster some 40,000 "refugees" were still living in makeshift tent camps throughout the city.[5] The camps posed a new worry: How long would survivors live in the city's parks? Concerned by the possibility of permanent squatter settlements, the civilian committee charged with leading the relief efforts debated how to clear the camps. In the midst of this quandary officials noted that many of those remaining in the camps had not lost everything. They still had jobs. With these low-income wage earners in mind, the committee arrived at a novel solution, one that would provide temporary housing for the working poor while guaranteeing an end to the camps. At the center of this strategy was the design for a small wooden cottage.

Between September 1906 and March 1907 San Francisco built more than 5,610 cottages designed by the Army Corps of Engineers. The cottages ranged in size from 140 square feet (13 sq. m) to 400

Timeline of Disasters and Responses

1900s

1906
San Francisco Earthquake and Fires
San Francisco, Calif., USA

1910s

1911
Triangle Shirtwaist Company Fire
New York, NY, USA
A blaze in a garment factory claims the lives of 146 workers, most of them women. Public outcry leads to the creation of fire safety codes.

square feet (37 sq. m) and cost between $100 to $741 to put up. Constructed by union carpenters and painted "Parkbench Green," the cottages consisted of only two or three rooms and were as easy to relocate as they were to build. Families rented the small cottages for $2 a month, which went toward the full purchase price of $50. To free the city's public parks, occupants who could purchase or lease a lot were granted ownership of the cottage and allowed to move it from the park at their own expense. Failure to move the cottages out of the camps by August 1907, a year and a half after the disaster, resulted in forfeiture of ownership.[6]

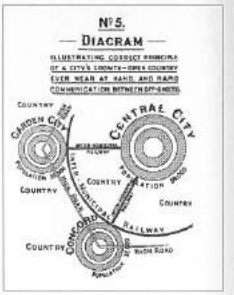
In this way the cottages provided not only decent temporary shelter but also a path to homeownership for hundreds of San Francisco's low-wage-earning families who might otherwise have never had the means to purchase a home. By the time the last camp closed in 1909, new homeowners had relocated more than 5,343 cottages.[7] Some of them are still in use today.

Until recently, the great earthquake of 1906 was considered the biggest natural disaster in American history. In its aftermath San Francisco implemented safer building codes and designed a more reliable water-supply system.[8] In addition, researchers conducted a thorough survey of the reconstruction effort. The *San Francisco Relief Survey* remains one of best-documented case studies of postdisaster shelter efforts to date. But if the earthquake offered lessons to future relief experts, they were lessons that would have to be relearned and rediscovered.

"Housing in the twentieth century has been one continuing emergency," wrote Charles Abrams, a prominent advocate for housing reform, in 1946. Today these words seem prophetic. For more than a 100 years housing has been gripped by a cycle of war, natural disaster, and poverty. Slums, whether cleared by earthquakes and floods or urban planners with bulldozers, disappear only to regenerate and grow larger. Refugees threatened by ever-more deadly conflicts flee across borders seeking shelter in neighboring territories. And, whether in countries rich or poor, nature has proved that no feat of engineering can completely shield a city from the rumblings of the earth or the rising of its waters.

For decades architects have been called upon to provide solutions to the world's shelter crises. However, as designers embraced the idealism of the machine age, the increasingly technology-driven, often utopian ideas they proposed carried little resonance for aid workers and others wrestling with the day-to-day realities of providing a roof, clean water, and sanitation to families in need. Over time, the worlds of relief and development became divorced from the worlds of architecture and design. What architects considered a design challenge, aid workers considered an issue of planning and policy.

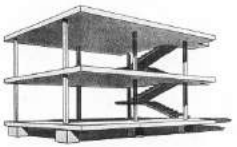
This disconnect would eventually lead to a crisis of faith: What role should design play in providing basic shelter? How could architects best address the needs of the displaced and disenfranchised? And, at the heart of these questions: Should design be considered a luxury or a necessity? This issue would plague not just architects but also planners, policymakers, and aid organizations struggling to balance the logistics of providing shelter with the human longing for a place to call home.



Ebenezer Howard's Three Magnets and No. 5 diagrams illustrate his concept of a planned community that would offer the best of both town and country.

1914–15
Maison Dom-ino
Paris, France
Le Corbusier

1914–18
World War I



1917
Demountable Wooden House
France (various locations)
American Friends Service Committee
Built by volunteers to house World War I refugees, each "demountable" wooden house consisted of two rooms.
American Friends Service Committee

"We are dealing with an urgent problem of our epoch, nay more, with the problem of our epoch. The balance of society comes down to a question of building. We conclude with these justifiable alternatives: Architecture or Revolution. Revolution can be avoided."

Le Corbusier, *Vers une Architecture*, 1923

Utopian Urbanism

The introduction of new building codes was just one of a series of profound changes that would affect the practice of architecture at the start of the twentieth century. The origins of humanitarian, or social, design can be traced at least as far back as the tenant movements of the late 1800s and early 1900s, when social reformers turned their attention to the housing conditions of the poor.

By the nineteenth century increased urbanization brought on by the Industrial Revolution had led to squalid conditions in the working-class neighborhoods of many cities. Photographers such as Thomas Annan in Glasgow and Jacob Riis in New York used their art to document the "insalubrious" living conditions of the "other half." Tenant associations formed, and worker housing initiatives took shape. Many of these housing projects, such as the Familistère in Guise, France, a "working-class palace" founded by the industrialist Jean-Baptiste-André Godin, were undertaken by companies on behalf of their workers.[9] Health, welfare, and productivity became inextricably linked to housing. The reform movement's call for sanitary living conditions led to the introduction of light wells and other design improvements for tenement housing.

Reformers also adopted the concept of town planning as an antidote to the social ills of the day. In 1898 Ebenezer Howard published *To-morrow: A Peaceful Path to Real Reform*. Howard offered a vision of planned communities free of "slums and gin palaces," where clean air, water, and opportunity would abound. In his plan, a central city surrounded by green space was linked by transportation to satellite towns. As illustrated by his famous Three Magnets and No. 5 diagrams, these satellite cities promised the best of both town (opportunity, amusement, high wages) and country (beauty, fresh air, low rents).[10] This concept of town planning combined with modernism would have a profound influence over the construction of low-income housing projects for decades to come.

Modernism

By 1913 the Industrial Revolution had reached a fever pitch. Reinforced concrete, first developed in the 1860s, was by now an accepted building material. Steel-frame construction, water pumps, and the invention of the elevator allowed buildings to soar to unprecedented heights. The devastation of World War I had led to acute housing shortages in much of Europe. At the same time, workers continued to migrate to urban areas, crowding into sprawling slums on the edges of cities such as Paris. This surge in demand called for new thinking about housing design as well as building techniques that not only met the needs of the new machine age but also co-opted its methods.

Today modernism is associated with a minimalist aesthetic of steel and glass, but it began as an attempt by architects and designers to harness the potential of industry to produce low-cost buildings, in particular, housing. The assembly line was revolutionizing the production of everything from toothbrushes to brassieres. Why not housing?

Le Corbusier expressed the new thinking best when he described the house as "a machine for living in." In 1914–15 the Swiss-born architect developed a basic, universal housing unit called the Maison Dom-ino. The unit consisted of little more than floor slabs of reinforced concrete supported by corner columns and lifted off the ground by pilotis, or piers. It could be repeated endlessly or stacked upon itself. Because the walls were not load bearing, the interior spaces could be configured in different ways to meet the varying needs of occupants.[11] Prefabricated walls and uniform door and window heights simplified construction further. Le Corbusier saw his system as a solution for the rapid reconstruction of regions such as Flanders, which had been heavily damaged during World War I. He

1920s

1919
League of Nations established
Versailles, France
Established after the end of World War I, the League of Nations' goal was to settle disputes between nations and foster peace. After World War II it would be replaced by the United Nations.

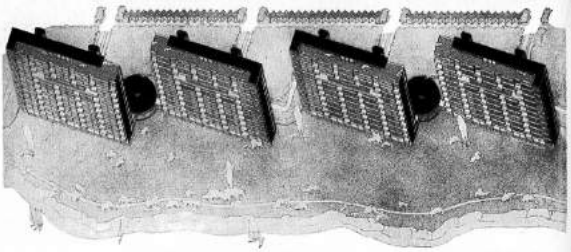
1923
Kanto Earthquake and Fire
Tokyo and Yokohama, Japan
200,000 people die; 370,000 buildings are destroyed. Frank Lloyd Wright's "earthquake-proof" Imperial Hotel (1916–22) is one of the few structures left standing.

1927
Mississippi River Flood
Lower Mississippi region, USA
The lower Mississippi River floods, inundating 27,000 square miles and shattering levee systems from Illinois to the Gulf of Mexico.

1927–32
"The Winona"
Sears Modern Homes
Akron, Oh., USA
Sears, Roebuck and Co.

"Architecture is a process of giving form and pattern to the social life of the community. Architecture is not an individual act performed by an artist-architect and charged with his emotions. Building is a collective action."

Hannes Meyer, director of Bauhaus, 1928 to 1930



Walter Gropius, slab apartment blocks on the Wannsee Shore, Berlin, 1931

built two prototypes based on his ideas for exhibition: The *immeubles villas* (1922) and the Maison Citrohan (1922), a play on the automobile name Citroën. Throughout the '20s Le Corbusier expounded on his ideas for a new industrialized architecture in a series of manifestos and urban plans.

Another early pioneer of prefabrication and component building systems was the German architect Walter Gropius. Gropius, who founded the Bauhaus and served as its director from 1919 to 1928, personified the architect as public servant and teacher. Throughout the '20s and '30s Gropius experimented with prefabricated wall panels and eventually whole structures. During his tenure and that of his successors, the Bauhaus became a nexus for socially conscious design.

Gropius, along with Marcel Breuer, is also credited with designing the first slab apartment block. This new building type, which would become the model for many future affordable-housing projects, was conceived to overcome the cramped, lightless tenement housing that had resulted from rampant land speculation at the turn of the century. The basic plan consisted of parallel rows of four- to 11-story apartment blocks. Each slab was only one apartment deep with windows front and back. The slabs were sited on a "superblock" at an angle to the street with communal green spaces between them to allow maximum sunlight into each apartment.[12]

Others would also experiment with standardized building components, modular systems, and prefabrication, including the French industrial designer Jean Prouvé and Frank Lloyd Wright, but perhaps none more passionately than the American inventor R. Buckminster Fuller.

Fuller arrived on what he termed "spaceship earth" in 1895. Like Gropius and Le Corbusier, he believed that mass-manufactured dwellings represented the future of housing. His most lasting contribution, however, was his fervent belief in the power of design to improve the human condition. In a sense Fuller, who was known for his eccentric use of language and his marathon lectures (the longest lasted 42 hours and only recently has been fully transcribed), was the first evangelist of humanitarian design.

In 1927, after the death of his elder daughter and the collapse of his first business, he found himself at the edge of Lake Michigan contemplating suicide. He was a failure, "a throw-away." What brought him from the brink, he later recounted, was the simple idea that his experience might ultimately be somehow useful to his fellow human beings. Rather than taking his own life, he decided to embark on a lifelong experiment, using himself as his own best research subject. He became "Guinea Pig B" (for Bucky), the world's first test pilot of a "design-science revolution," the sole purpose of which was to improve "human livingry," and he started with the house.

1930s

1929
Dymaxion House
Chicago, Ill., USA
R. Buckminster Fuller

1930
Housing Act of 1930
England

1930–39
Drought and Dust Storms
Midwestern and southern plains, USA

1931
Prefabricated houses built for the Hirsch Copper and Brass Works
Finow, Germany
Walter Gropius
Arthur Kester

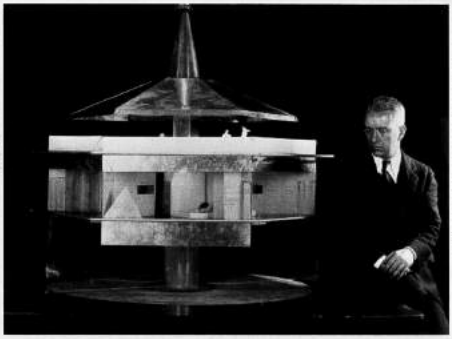
1931
Slab apartment blocks on the Wannsee shore
Berlin, Germany
Walter Gropius

Conventional "handcrafted" homes had undergone "no structural advances in 5,000 years," Fuller argued. They were poorly lit, required much maintenance, and did not make efficient use of raw materials. Most conventional buildings depended on gravity for their strength. But what if a building could be suspended, as a sail from a mast, allowing for greater strength and the use of fewer materials?

Fuller's thinking led to the design of the Dymaxion House, a small-scale model of which was first exhibited at a Marshall Field's department store in Chicago in 1929. His radical scheme embraced the principle of tension and aimed to do "more with less." It was spherical, to make efficient use of materials, and clad in maintenance-free aluminum. It was naturally climate controlled and could be lit by a single light source through a system of mirrors and dimmers. All the mechanicals, wiring, and appliances were built into the walls and mast to allow for easy replacement. The house was also one of the first examples of self-sufficient (or "autonomous," as Fuller put it) green design. Wind turbines produced energy. The roof collected rainwater. Water-saving "fog guns" handled washing (including people), and Fuller's "package toilet" composted waste and recovered methane gas.[13]

While the Dymaxion House was unabashedly ahead of its time (it would be two decades before Fuller could find backing to build a full-scale prototype), the concept of building with tension rather than compression would become central to Fuller's work and would eventually lead to his most lasting contribution to the field of humanitarian design: the geodesic dome. Fuller's principle of tensegrity became a staple of tent design, and by extension, emergency shelter, that endures to this day.

Like the Dymaxion House, few of these early designs for "factory-built" housing achieved widespread commercial viability. For example, Le Corbusier's low-cost housing for workers in Pessac, near Bordeaux, France, went unoccupied for eight years after it was built. However, this concept of mass-produced housing would have a number of lasting implications for low-cost shelter. It prefigured a move away from the craft of building toward the technology of building. It took design out of the realm of the many and put it in the hands of an educated few. Perhaps more important, it negated the need for a dialogue between the architect and the occupant.



R. Buckminster Fuller with an early model of his Dymaxion House
Buckminster Fuller Institute

Suddenly a house could be designed, detailed, and delivered without the architect ever meeting its owner.

Manufactured Housing

Meanwhile, in the rest of America, the industrialization of architecture took a very different tack. By the early '20s the automobile had become an integral part of American life. Trailers were common and had been adapted by migrant workers and others into dwellings. With the onset of the Depression, the demand for cheap, portable housing grew. A mobile home seemed the next logical step. In 1936 Wally Byam built the first Airstream trailer, a steel-clad, aerodynamic embodiment of home on the road. Although the Airstream would eventually become an American icon, designs such as the Durham Portable House would prove far more influential.[14]

Not only did the Durham, which cost between $1,500 and $3,000, mimic the styling of a conventional home, it also was a precursor

1931
Flood
China
The Yellow River, the second largest river in China, floods. Death toll estimates range from 650,000 to four million. The flooding is followed by famine and outbreaks of disease.

1934
Modern Housing
Catherine Bauer

1934
National Housing Act of 1934
USA

1936
Airstream Clipper
Los Angeles, Calif., USA
Wally Byam

1937
Housing Act of 1937
USA

to the "double-wide" mobile home because it was transported in two parts and assembled on site to form a single dwelling.

Although its architectural merits have been the subject of contentious debate, the mobile home in many ways represents the dream of prefabricated housing come true. According to US census figures, the number of mobile homes has increased from 315,000 in 1950 to nearly 8.8 million today.[15] Approximately 18 million Americans now live in mobile homes. According to research by faculty and students at the Harvard Graduate School of Design, mobile homes have become the most common form of unsubsidized affordable housing in America—despite hostile community boards and zoning laws, higher financing rates for mobile homes than standard mortgages, and the tendency to use shoddy materials and construction. Today mobile homes account for an astonishing 25 percent of all dwellings in North America.[16]

The popularity of mobile homes raises an interesting question: Why have double-wides received such broad acceptance, while other seemingly better designed alternatives have not? The answer may lie in their mobility. With each "box" no wider than a standard highway and production rigidly controlled, the units were cost-effective to make and to transport. For the first time, housing became a product within reach for low-income wage earners and those on fixed incomes. Land could be rented at a nominal fee, and no complicated applications needed to be submitted for government handouts. Manufactured homes filled a growing niche in the housing market and quickly became a part of the American vernacular.

The mobile home was not the only successful attempt to market mass-produced housing in America before World War II. Between 1908 and 1940 the American retailer Sears, Roebuck and Co. sold as many as 100,000 homes from its catalogue.[17] While not truly prefabricated (the homes were delivered in some 30,000 parts by boxcar, complete with assembly instructions and two tree planters for the front yard), for a brief moment these "mail-order" homes offered an affordable alternative to traditional construction in places where materials and expertise were scarce. The homes could be purchased with no money down at prices starting from as little as $650, compared to the average home price of $1,000. What's more, the company guaranteed that "a man of average abilities" could build one of its kit homes in just 90 days.[18] The Sears approach offered a surprisingly efficient, well-crafted alternative to the concept of delivering fully finished prefabricated homes.

Most Sears homes used wood-frame construction and were conservative in style. However, in 1934 the retailer partnered with the General Houses company to exhibit a truly modern steel-frame home made from prefabricated wall panels at the 1934 World's Fair in Chicago. But by then the stock market had crashed. Homeowners defaulted on their mortgage payments in droves, and in 1940 Sears was forced to shut down its Modern Homes division.[19] The kit-home approach was never revived on a large scale, and mobile homes became the industry standard.

The Social Housing Movement

With the real-estate collapse brought on by the Depression, providing housing for low-income workers took on new urgency. High unemployment and rampant foreclosures sent many onto the street and into cities in search of work. Lending institutions became reluctant to make home loans, and with down-payment requirements as high as 50 percent, few people could afford one anyway. Deteriorating conditions and health concerns in rapidly expanding slums provoked governments to act, spawning a number of urban revitalization and progressive-era housing initiatives.

In England the Housing Act of 1930 tied the construction of government subsidized housing, or "council housing" (which had begun after World War I), to slum-clearance programs in the inner cities. With the Labour Party's ascension to power in 1934, London adopted the slogan, "A Healthy London: Up with the Houses, Down with the Slums."[20] Some 200,000 people were resettled, mostly from inner-city London to surrounding suburbs.

In America many of the programs that would fund the large-scale public housing and Urban Renewal schemes of the postwar era were conceived during the Depression. As foreclosures forced tens of thousands from their homes, a group calling themselves "Housers," which counted the activist Catherine Bauer among its leading members, lobbied Congress to intervene.[21]

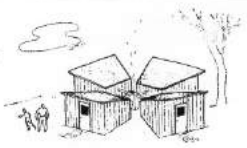
Congress responded with the National Housing Act of 1934. The act created the Federal Housing Administration (FHA), which

1938
Durham Portable House
USA
M. R. Doberman and John W. Davis

1939
Earthquake
Concepción and Chillán, Chile
50,000 are killed and 700,000 left homeless. 70 percent of Concepción is destroyed and virtually all of Chillán.

1939–45
World War II
Millions are displaced. Emergency housing is still being constructed four years after D-Day.

ca. 1939–45
Transportable Primitive Shelter
Helsinki, Finland
Alvar Aalto
Movable temporary shelters are designed to house war refugees.



1940s

1940
Dymaxion Deployment Unit
Various overseas US military bases
R. Buckminster Fuller
The units, produced by Butler Manufacturing, provide emergency accommodation for troops in various locations during World War II.
Buckminster Fuller Institute

"Housing in the twentieth century has been one continuing emergency."

Charles Abrams, *The Future of Housing*, 1946

guaranteed home-mortgage loans, making it possible for the first time for banks to offer individual home buyers mortgages on terms familiar today, such as 30-year repayment periods and 10 percent down payments. Considered one of the most significant acts ever passed by Congress, the National Housing Act triggered mortgage lending, stimulated a building boom, and opened the door to home ownership for millions of working-class Americans. It is credited with helping to increase the national homeownership rate from under 40 percent during the Depression to almost 67 percent today.[22]

However, the act also gave rise to the practice of "redlining." In order to reduce its financial exposure, the government developed a system in which lenders could refuse to make loans in neighborhoods considered high risk by appraisers. Residential areas were mapped, and neighborhoods that showed signs of decay or "undesirable populations," typically those with ethnic minorities, were marked in red. A single home occupied by a minority family in a distant corner could cause an entire neighborhood to be downgraded for federally backed home mortgages.

In addition, while the Housing Act of 1934 stimulated construction, it did little to shelter those who could not qualify for loans—the nation's poor. As a remedy Congress passed the Housing Act of 1937, which authorized more than $800 million in loans to local housing authorities for the construction of housing for low-income families. The act required that for every dwelling built, the equivalent number of substandard dwellings must be cleared.[23] It was a centralized, top-down approach. Policies were enacted at the national level and carried out locally.

Taken together, this legislation would have a profound effect on the landscape of American cities. By now urban and town planning concepts had gained critical mass in Europe and America. Housing activists extolled the virtues of "garden city" and "new town" planning concepts. Slums were to be cleared to make way for new planned communities. *The City*, a film sponsored by the American Institute of Planners in 1939, perfectly captured the populist, if somewhat paternal, idealism of the time.[24] "Order has come," the film proclaimed. "It's here! The new city, ready to serve a better age."

World War II

The true effects of these housing programs would not be felt for several decades, however. With the outbreak of World War II, the world's attention shifted. The search for a technological solution to the world's housing crisis was put on hold. Factories were retooled as technological advances made in the name of progress during the first few decades of the century were now put to terrifying use. For the first time in the history of warfare, civilian deaths outnumbered those of soldiers. The destruction of towns and cities was also unprecedented. American fighter pilots armed with just two atomic bombs leveled the cities of Hiroshima and Nagasaki in seconds. When the war ended in 1945, millions were left displaced or homeless.

Emergency shelter became a priority. The Finnish architect Alvar Aalto developed a temporary emergency-shelter system that could be trucked to the site and house four families with a shared central-heating unit.[25] Prouvé also developed a number of prefabricated shelters, including a metal-frame tent, demountable barracks, and schools for war refugees that he called *écoles volantes* (flying schools).[26]

The Marshall Plan pumped $12 billion into the reconstruction of Europe and became a model for postconflict humanitarian aid. Military agencies were tasked with providing engineering and technical assistance in the reconstruction of ports, roads, bridges, communication lines, and other infrastructure. It was a role they would play increasingly in postconflict and disaster situations.

The war also marked another major shift: the rise of the NGO, or nongovernmental organization. With the exception of the International Committee of the Red Cross, which was founded by Henri Dunant in the 1860s, most of the large organizations and agencies we've come to associate with humanitarian work today were born amid the suffering and remorse that followed World War II. These include not only the United Nations but also government agencies such as Danida and the United States Agency for

1943
Famine
Bangladesh and West Bengal, India (formerly Bengal)
Crop failures and political complications caused by World War II prompt a sharp rise in the cost of rice and cause widespread famine, malnutrition, and related diseases, killing more than three million people.

1943–48
Packaged House System
Long Island, NY, USA
Walter Gropius and Konrad Wachsmann

1944–47
Wichita Dwelling Machine
Wichita, Kan., USA
R. Buckminster Fuller
The dwelling, shown at right, is based on Fuller's original concept for the Dymaxion House.
Buckminster Fuller Institute

International Development (USAID); humanitarian aid organizations such as the International Rescue Committee, CARE, and Oxfam; and religious organizations such as Catholic Relief Services.

From this point on, NGOs would play an increasingly larger role in providing emergency shelter to refugees as well as responding to natural disasters. After the war the end of colonization ushered in an era of conflict as states struggled for independence. Aid agencies were faced with the need to provide emergency shelter—not just in Europe and America but also throughout the rapidly industrializing "third world."

As their number proliferated in the postwar years, NGOs became more involved in development work, building water and sanitation systems and affordable housing. And the field of housing became more specialized: Disaster relief and development work became two separate fields; slum clearance and urban renewal initiatives were now differentiated from the construction of low-cost housing in rural areas. Increasingly, NGOs cultivated areas of expertise and contracted with governments and other institutions to meet specific humanitarian goals, becoming in a sense specialized service providers. Some employed architects but most depended on engineers to design and oversee the construction of projects.

The Postwar Building Boom

The destruction of World War II, the return of veterans, and the prewar housing shortage combined to create an unprecedented demand for housing. As people tried to put the war behind them and reconstruct their towns and cities, modernism, with its implicit denial of the past and its promise of efficiency and affordability, seemed the perfect vehicle. In West Germany planners embraced the slab apartment block that Gropius and others had first explored in the '20s and '30s. In France Le Corbusier was called upon to put many of his earlier ideas into practice for a project in Marseilles, the Unité d'Habitation. Built between 1946 and 1952, the tower block was composed of 300 residential units stacked between shopping arcades and restaurants to form a sort of neighborhood on stilts. In the postwar years Le Corbusier would also be hired to create urban plans for Izmir, Turkey; Bogotá, Colombia; and Chandigarh, India. The communist states of Eastern Europe also co-opted modernism

"This is the real news of our century. It is highly feasible to take care of all of humanity at a higher standard of living than anybody has ever experienced or dreamt of. To do so without having anybody profit at the expense of another, so that everybody can enjoy the whole earth. And it can all be done by 1985."

R. Buckminster Fuller, lecture

as part of their ideologies. Shiny "new towns" emerged from the postwar rubble of such disparate places as Poland, Japan, and Israel.

Meanwhile, the war had done little to shake architects' faith in technology. Once again designers returned to the idea of mass production. Governments allocated grants for housing returning veterans, and dwellings such as Fuller's Dymaxion House and the solid-steel Lustron Home (1945–51) found their way onto magazine pages.[27] Gropius, having fled Nazi Germany for the United States, continued to develop prefab systems and partnered with Konrad Wachsmann and the General Panel Corp. in New York to market the Packaged House System (1943–48). The company built some 200 homes in California, but the venture was a financial failure and shut down after five years.[28]

In France a prefab system designed by Prouvé would meet a similar fate. Working from a design he had originally intended to house bureaucrats in French-colonized Congo, the Ministry of Construction in 1949 ordered 25 prefab homes for an experimental low-cost housing scheme. Unfortunately, no delivery instructions were issued and the houses were still waiting at the factory a year later. In the end only 14 were sited in a housing estate in Meudon, outside Paris.[29]

The limited success of these and other prefab projects did not prevent the idea from being exported to the desperate housing ministries of the developing world. For example, according to Charles

1945
Houses for Britain
USA
The US Federal Public Housing Authority prepares to ship 30,000 prefabricated temporary emergency family dwellings to Great Britain under lend-lease. Plumbing and fixtures are to be shipped with the structures, but not sinks or closet doors.
Library of Congress

1945
United Nations founded
San Francisco, Calif., USA

1945–51
Lustron Home
Columbus, Oh.,USA
Carl Strandlund
The Lustron Home retails for $7,000. Despite a government pledge of $40 million, only 2,498 homes are produced before the company forecloses in 1951.

Abrams, in the postwar years precast concrete walls poured in Europe were hauled to Ghana by a company that contracted with the government there to build 168 model houses as the start of a larger building program. When the cost of 64 completed houses ran up to $448,000, Ghana quietly abandoned the venture. In Karachi, Pakistan, small aluminum prefabs were constructed, which their owners promptly adapted and expanded with adobe, discarded wood, and other makeshift building components, making them, in Abrams's words, "the first prefabricated slums."[30]

Ultimately, the cost per unit of off-site manufactured housing made most prefabricated dwellings prohibitively expensive for those living on the economic margins. Though examples of postwar prefabricated homes dot America, Europe, and other parts of the world, in the end they could not compete with their more affordable mobile-home counterparts or the new suburban Levittowns that would soon become synonymous with the American dream and postwar prosperity.

The first Levittown, named after its developer, William Levitt, was constructed in Long Island between 1947 and 1951. At the time it was the largest housing development ever constructed by a single builder. But in terms of humanitarian design and construction, the landmark project was significant for another reason: It transferred the concept of assembly-line production from the factory to the building site.

Modeled after one of Henry Ford's wartime plants, the original Levittown consisted of 17,447 homes, each built by construction teams that moved from lot to lot, performing the same task over and over as trucks drove through the area dropping off supplies. The homes, which came in only two styles, were priced at less than $10,000 so that buyers could qualify for federally backed loans. Beginning in the 1950s Levittown-style developments cropped up in places as far-flung as Brazil and the Philippines.[31] Levitt himself went on to build developments in Iran, Venezuela, Nigeria, France, and Israel, and his model remains the dominant construction method for affordable single-family housing developments today.

Urban Renewal

The postwar years also saw the continuation—and expansion—of the slum-clearance programs begun during the Depression. In France the Debré Act of1964 authorized slum clearance in Paris. In Britain the unemployed and working poor were resettled into council housing built on land leveled by bombs during the war.

In America planning types were given sweeping new powers by the 1949 Housing Act, which financed slum clearance in aid of Urban Renewal programs and authorized the building of 810,000 public-housing units. The act's stated goal was to provide "a decent home and a suitable living environment for every American family." But its passage led to the destruction of more homes than were built, betraying the very families it was intended to help. Whole neighborhoods were bulldozed in the name of progress and replaced by freeways and government complexes. Zoning pushed low-income housing to city peripheries. At the same time, redlining triggered "white flight" in urban areas such as Detroit, increasing the segregation of America's inner cities and creating pools of poverty in once-vibrant neighborhoods. Rather than fulfilling the promise of decent housing, Urban Renewal programs left a legacy of corruption, rioting, poverty, crime, discrimination, despair, and isolation.

In the beginning many of these new developments consisted of low-rise apartment buildings, but over time Le Corbusier–inspired high-rises and slab apartment blocks of the kind designed by students of the Bauhaus became the norm. As a result, in the public eye at least, the modernist tower block became the scapegoat for an era of flawed housing policies. The sight of demolition crews dynamiting projects such as Pruitt-Igoe, a 33-tower public housing project in St. Louis, Missouri—once heralded for its innovative skip-stop elevators, communal laundries, and common spaces—just 20 years after its construction seemed to confirm public opinion. By the 1970s it was clear to many that the postwar approach to public housing had failed. Slums had not been replaced by "new towns" or "radiant cities" but by "vertical ghettos."

Poor siting, cost cutting, and shoddy construction compounded the problems associated with the new housing developments. In 1968 a gas explosion caused the corner of a tower block to collapse in the London docklands, killing two residents and injuring another 260.[32] Two years later in Korea, 32 former slum dwellers who had been relocated into a high-rise housing block were killed when it came crashing down.[33]

1946
The Future of Housing
Charles Abrams

1946–53
New Gourna Village
Near Gourna, Egypt
Hassan Fathy

1947–51
Levittown
Long Island, NY, USA
William Levitt
Levitt pioneers on-site assembly-line construction. The 17,000-home development foreshadows today's "blitz builds."
Library of Congress

1947–52
Marshall Plan
The United States commits $12 billion to the reconstruction of Europe.

Despite these warning signs, the "clean-slate" approach of Urban Renewal continued to shape the policies of overcrowded cities of the developing world, where they were embraced by governments struggling to cope with squatter invasions and exploding populations. Throughout the 1960s and 1970s governments in countries such as India, Zambia, and El Salvador approved wide-reaching slum-clearance programs in the name of economic development. However, housing construction could not keep pace with demand, and ultimately these programs did little to deter informal settlements. The population of Mumbai (formerly Bombay), for example, grew from nearly three million in 1951 to nearly six million in 1976, with 2.8 million people, or just under half the city, living in slums.[34]

Self-Help and Sites-and-Services Programs

Whether or not the design of these buildings led to their demise, the very public failure of modernist public-housing initiatives prompted a general loss of confidence in architecture and its ability to improve lives. As early as the '30s and '40s even some within the profession were beginning to question the role of architects in serving the needs of those who could least afford their services.

"Of all the participants in the business of home building, the architect is the only one qualified to guide the house and its environment toward a civilized form. Well-trained and possessed of practical experience, he should be intellectually constituted to prevent abuses, develop new methods and impart originality to the design. Yet he fails in each of these responsibilities," wrote Abrams in his landmark survey of the housing industry, *The Future of Housing*. Leadership in improving the design of low-cost homes was coming from the materials industry, he argued, not architects. Others felt that architects tripping over their own stylish egos in the pursuit of wealthy clients "had lost sight of the requirements for elementary shelter."[35]

A debate emerged in the profession: Should the work of the architect be limited to design? Or should architects roll up their sleeves and take on the job of the housing activist, working to influence not only implementation but also policy and planning decisions? Could architects play a meaningful role in providing shelter to those who needed it most? And if so, what should that role be?

The self-help housing movement grew out of this disillusionment. Homeowners had been successfully building their own homes for generations. Moreover, they had been doing it without the aid of government agencies, architects, or outside funding. What were slums but just another form of owner-built housing? Rather than pour money into government-built housing projects, why not use government funding to support and empower families to upgrade and build their own homes? This was the idea at the crux of the self-help movement.[36]

One of the most notable early experiments in self-help-style housing was the work of Hassan Fathy in Egypt. In the 1930s Fathy began experimenting with mud-brick construction. Trained at what is now the University of Cairo, he was inspired partly by the beauty and sustainability of traditional Egyptian architecture and partly by a shortage of timber, steel, and concrete during the war. After building a number of rural homes using traditional vaulted roofs and mud brick, including a demonstration home for the Red Crescent in a village destroyed by a flood, he was asked by the country's Department of Antiquities to design a large resettlement project.

The village of Gourna, Egypt, was situated near, or more accurately above, the Tombs of the Nobles. At the time its residents had a certain renown for finding suspiciously authentic Egyptian relics in their cellars. In an effort to protect the site from tomb-raiders, the government planned to resettle the community in a new village to be built nearby called New Gourna.

For Fathy the project presented an opportunity to test out his ideas of a low-cost architecture based on the sustainable building techniques that had sheltered centuries of Egyptians. To him, "apostles of prefabrication and mass production" did not appreciate or understand the depths of poverty in places like Egypt. "There is no factory on earth that could produce houses these villagers can afford....To talk of prefabrication to people living in such a condition is worse than stupid. It's a cruel mockery of their condition," he wrote. Nor, he felt, could government largesse alone effectively address the problem:

> It is a pity that government authorities think of people as "millions." If you regard people as "millions" to be shoveled into various boxes like loads of gravel...always needing things done to them, you will miss the biggest opportunity to save money ever presented to you. For, of course, a man has a mind of his own, and a pair of hands that do what his

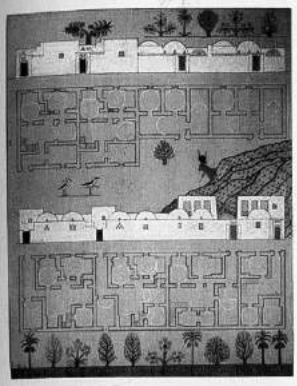
1948–49
Geodesic Dome
Asheville, NC, USA
R. Buckminster Fuller
Fuller teaches at Black Mountain College and invents the geodesic dome. Over the course of the next several decades he will refine and expand on the basic design. At right, an early example of a geodesic dome is lifted into place.
Buckminster Fuller Institute

1949
1949 Housing Act
USA

1949
Tsunami
Hawaii, USA
50-foot waves, some moving as fast as 490 mph, kill 96 people in the city of Hilo and destroy 46 homes. The Tsunami Warning System is created, with five seismic stations around the Pacific Rim.

1950s

1953
Storm Floods
North Sea, northern Europe
100-mph winds cause a sea surge to crash into coastal Britain, Holland, and Belgium. In Holland the tidal waves cause dikes to break in 65 places; in Britain sea walls are breached in 1,000 spots. Flooding causes 1,800 deaths. The disaster leads to the creation of the national Storm Tide Forecasting Service and the erection of the Thames Barrier, the world's largest movable flood barrier.



Hassan Fathy, plan of New Gourna Village, Egypt, 1946
Aga Khan Foundation

> mind tells them....Give him half a chance and a man will solve his part of the housing problem—without the help of architects, contractors, or planners—far better than any government authority ever can. Instead of one architect in an office sitting up all night to find out how many houses of each size will best fit the masses to be housed, each family will build its own house to its own requirements, and will inevitably make it into a lively work of art. Here, in each private person's longing for a house, in his eagerness to make one himself, is the alternative to the disastrous mass housing schemes of so many governments.[37]

Fathy saw the role of the architect as that of personal consultant yielding his or her training to the aspirations of the homeowner and to the demands of local construction methods and materials. New Gourna was to be a village built by the villagers themselves. Work on the new community, which was planned to include a mosque, a school, a theater and other amenities as well as housing, began in 1946 and continued through 1953. All the buildings were constructed using mud-brick and traditional craftsmanship, down to the doors. But the project did not to live up to Fathy's expectations. From the beginning he found it difficult to develop a true client-architect relationship with the villagers, who resented being resettled and expected their homes to be delivered as finished products. Fathy had envisioned training villagers in the craft of mud-brick building and employing them to build their own homes, but because of their opposition toward the project as a whole, he was forced to hire outside labor. Construction was slowed by "application-in-triplicate" supply procedures, snafus, and a lack of support.

Government ministers viewed the project as a sentimental folly at best and a waste of time and money at worst. The most damning critique came from other architects, who felt that the town failed to fulfill its residents' desires for modern living. The people of Gourna refused to move to the new village. When Fathy went back to the unfinished village some 20 years later, he found it all but abandoned.

Even in failure, however, the New Gourna experiment left a lasting legacy, not the least of which is *Architecture for the Poor*, Fathy's detailed and moving account of the project and its shortcomings.[38] Written 20 years after construction at New Gourna was halted, it offers solace to all architects who find themselves in the soul-destroying task of trying to overcome institutional obstacles beyond their control. Fathy's philosophy of building by the poor for the poor would have a profound influence on a growing cadre of architects working on issues of housing in the developing world.

At the same time that Fathy was building New Gourna, an even more ambitious and far more successful "self-help and mutual aid" project was under way in Puerto Rico. It was initiated as part of a government resettlement and land redistribution program. Some 67,000 farm workers were given small plots of land averaging three acres each. Housing construction began in 1949, and families were organized in groups of 30 to work on each other's homes. Revolving loan funds were set up, and officials traveled to each village to encourage participation. Once families signed on, a construction supervisor and a social worker were assigned to each group. Unlike in New Gourna, families were free to design and build their homes using any method that made sense—whether that involved

1955–63
Lafayette Park
Detroit, Mich., USA
Ludwig Mies van der Rohe and Ludwig Hilbersheimer (completed by other developers and architects)
Part of a federally subsidized Urban Renewal project, the development includes town houses and 21-story apartment blocks, grassy expanses, and a system of closed streets.

1958
Earthquake
Arequipa, Peru
10,000 houses destroyed. John F. C. Turner initiates a self-help rebuilding program.

1958
Low-Income Housing
Chandigarh, India
Pierre Jeanneret
James Burke/Time & Life Pictures

traditional construction or not. Between 30,000 and 40,000 small houses were built by the early 1960s.

This program would eventually influence a number of self-help and mutual-aid housing initiatives, including the work of John F. C. Turner, who launched a similar program to rebuild some 10,000 homes destroyed by an earthquake in Peru in 1958. Turner later adapted (and simplified) the model to implement a number of slum-upgrade programs, negotiating one of the first loans from the Inter-American Bank for housing aid in Peru.[39]

Over time a variety of approaches to the basic self-help housing concept emerged. One variant was the roof-loan scheme. In this approach, first developed by Abrams and Otto Koenigsberger as part of a United Nations mission to Ghana in the 1950s, families who had built the foundation and walls of a structure themselves received loans from a revolving fund, repayable over a fixed period, to buy the roof, doors, and windows. Another variant was the "core-housing" scheme, in which agencies provided a number of identical "cores," typically consisting of one room that in some cases included basic services such as water and electricity. The families could then expand these cores as time and money allowed. Many houses erected in the later years of Puerto Rico's self-help program followed this "core" model.

Then in 1968 a young American couple named Millard and Linda Fuller took the basic tenets of self-help and mutual aid in yet a new direction. The idea for Habitat for Humanity was born at Koinonia Farm, a small, interracial Christian farming community founded in 1942 outside Americus, Georgia, by farmer and biblical scholar Clarence Jordan. Working with Jordan the Fullers helped set up a revolving loan fund and orchestrated a program to build 42 homes. Future owners and volunteers worked "in partnership" to construct the homes, which were sold to families in need at no profit with no interest. Jordan died before the first home was completed, but the Fullers carried on his work.

Although Habitat for Humanity is considered an American organization, the first housing project the Fullers undertook on their own was in Zaire (now the Democratic Republic of the Congo). Starting in 1973 they built 100 cement-block houses over three years. On returning to America they officially formed Habitat for Humanity International in 1976, with its headquarters in Georgia. The mission of the organization, which the Fullers described as a "Christian housing ministry," was to eradicate "poverty housing" by building "simple, decent homes" based on the "economics of Jesus." Within 30 years Habitat for Humanity would claim to be the fifteenth-largest homebuilder in the United States.

The Habitat for Humanity "partnership" model offered a number of advantages over typical self-help and mutual-aid programs. Whereas prior self-help initiatives relied primarily on the labor of families themselves, often forcing wage earners to give up paid work, Habitat for Humanity involved volunteers, speeding the construction process and lessening the burden on already struggling families. Moreover, whereas administrative and organizational costs absorbed as much 25 percent of the funding for a typical self-help and mutual aid program, Habitat for Humanity relied on the built-in organizational skills of local churches to help set up and run its housing initiatives. This not only cut down on costs but also helped overcome local resistance and potential siting hurdles, while guaranteeing a steady supply of volunteers and funding.

Habitat for Humanity published a how-to guide entitled *Community Self-Help Housing Manual* in 1982.[40] It included everything from basic house plans (which have changed little since then) to family selection guidelines to instructions on setting up your own Habitat for Humanity affiliate. Perhaps more than anything else, however, it was Habitat for Humanity's ability to build a grassroots network of zealous housing advocates, including former President Jimmy Carter, that secured its success.

The 1970s also saw a number of significant policy shifts. As the concept of self-help gained momentum, the poor were seen no longer as a burden but as a resource. The United Nations held a number of conferences focusing on urban settlements, at which Turner and others presented their work, and in 1972 the World Bank, drawing on the work of Abrams, Turner, and others, launched an urban lending program that paved the way for slum-improvement initiatives. Rather than investing in housing, the bank advocated investing in land, services, and utilities and, in some cases, granting secure land tenure to residents in existing squatter settlements.

One of the first of these "sites-and-services" projects the bank

1960s

1961
The Death and Life of Great American Cities
Jane Jacobs

1964
Architecture Without Architects
Bernard Rudofsky
The exhibition and publication of the same name celebrate the beauty of vernacular architecture, leading to a renewed appreciation for traditional building arts.

1964
R. Buckminster Fuller's geodesic domes and other forward-looking ideas earn him the cover of *Time* magazine.
Time Inc.

funded was in Lusaka, Zambia. Carried out between 1972 and 1975, it provided the construction of roads, installation of piped water to standpipes, security lighting, and garbage removal. The project also offered small loans to residents for housing improvements, including $375 to those forced to relocate to an overspill area to make way for the new services.[41]

Gradually slum redevelopment gave way to "upgrading."[42] The introduction of micro-credit lending helped spur the construction of pit latrines, water delivery, and self-help housing in former squatter settlements. Architects such as Reinhard Goethert and nonprofit groups such as the Cooperative Housing Foundation (CHF) in America and FUNDASAL in El Salvador began to play a significant role in advising governments on housing policy and implementing large-scale self-help and sites-and-services programs.[43]

Unlike previous government-managed programs, the sites-and-services and self-help models promoted self-reliance over institutional support. In terms of sheer numbers, at least, it was difficult to find fault with the approach. For example, between 1969 and 1984 the Kampung Improvement Program, funded by the World Bank, brought essential services to some 15 million people in Indonesia, and by 1996 Habitat for Humanity alone had dedicated some 50,000 homes.

However, in time housing experts recognized a number of shortcomings to the approaches.[44] Because people were unlikely to invest time and money in building or upgrading homes they didn't own, the self-help and sites-and-services models could not be adopted in areas where formal land-tenure was a political impossibility. Others pointed out that both models tended to relocate people who relied on work in the inner city to the city's periphery.

The need to meet financial targets placed an emphasis on quantity above quality. This resulted in homes so basic as to be almost bereft of design, lessening their value over time. Program mandates and policies did little to encourage green building or to mitigate the impact of human settlements on the environment. And whereas public housing—permanent and well serviced—had provided shelter at little to no cost to the tenant, self-help and sites-and-services occupants invariably paid more for less. In most areas, improvements still struggled to keep pace with population growth.

Although architects participated in and in many cases mobilized self-help housing programs, the very concept was a negation of the traditional role of the architect. Design was not perceived as adding value. Architects in the self-help housing model were mere trainers, if not unnecessary inconveniences. As Turner, one of the movement's most prominent advocates, put it:

> The certified professional makes a fool of himself, and often does a great deal of harm to other people, by assuming that he knows more than the uneducated by virtue of his schooling. All that second- and third-hand knowledge and intellectual exercising does for him, however, is to reduce his ability to listen and learn about situations significantly different from his own social and economic experience—with consequences that can be tragic when he has the power to impose his solutions on those who are not strong enough to resist.[45]

Once again the relevance of design and of the design professional was called into question. It would require a new generation of architects, policy makers, planners, humanitarian aid workers, and others to bridge the gap between design and policy. In doing so, they would not only reaffirm the essential role of design but demonstrate the importance of building sustainable communities.

The work of two mavericks stands out: Fred Cuny, who made the connection between disaster relief and development work, and Samuel "Sambo" Mockbee, whose thoughtful structures in rural Alabama brought the practice of architecture back to the design of low-cost shelter. In many ways the two led parallel lives. Both men operated on an act-first-and-ask-permission-later basis. Both were shunned by the establishments within which they operated, and both would be outlived by their charismatic, larger-than-life personalities.

When Cuny entered the field of disaster relief in 1970, not much had changed since World War II. Tents were the standard shelter response, and little attention was paid to camp planning. In most countries the military took the lead in responding to emergencies, followed by various housing ministries and other departments or agencies. For example, in the United States no fewer than 100 agencies were tasked with responding to disaster in one form or another. (It was not until 1979, when Carter created the Federal

1970s

ca. 1970
New government-subsidized low-cost housing in the Philippines (above) and Brazil (below).

1972
Freedom to Build
John F. C. Turner and Robert Fichter

1972
Pruitt-Igoe Housing
St. Louis, Mo., USA
Minoru Yamasaki
St. Louis Housing Authority begins demolition of the 33-building public housing complex.
Wide World Photos

Emergency Management Agency, that the many responsibilities for disaster assistance and response were consolidated into a single agency.[46] This led to duplicated efforts, complexity, and confusion.

What's more, little coordination existed between the nonprofit sector and government agencies. As Cuny would later write: "Most of the agencies operating at the time were oriented toward relief and charity. Development concerns were emerging, but few had yet seen a broader role for the voluntary agency. The favored relief approaches still relied mostly on short-term staff and volunteers. Because of high staff turnover, little accumulated wisdom was incorporated into the basic response pattern of the agencies."[47]

Designers offered up a steady stream of innovative emergency-shelter systems, from inflatable warehouses to polyurethane domes, but most were too costly or too cumbersome to implement. Prototypes for "instant housing" that had failed in one disaster would reappear in slightly altered form in the context of another.

"[Architects] were typically doing these Darth Vader things with helicopters and gee-whiz materials. They came at it with enthusiasm or commercial interest. There was a lot of experimentation going on. The fact that shelter had to come out of local material and processes eluded these people. When you told them that you can build a permanent house in Bangladesh in three days for the same amount of money they were proposing to spend on temporary housing, they ignored you," recalled architect Ian Davis, a shelter consultant with the United Nations and a colleague of Cuny's.[48]

Meanwhile, tents—the solution of choice for most aid agencies—would be shipped over great distances at great cost only to go unused because they arrived too late or were sited in camps away from homes, businesses, and livestock.

At the same time studies began to make a correlation between substandard housing, increased urbanization, and a community's vulnerability to natural disasters. "The study of disasters is almost by definition a study of poverty within the developing world," wrote Davis in his book *Shelter After Disaster* (1978), one of the first analyses of the design, as opposed to the logistics, of emergency shelter.[49] Yet in the reconstruction of housing in disaster-prone areas, aid agencies paid scant attention to disaster mitigation in terms of design, siting, or environmental impact. By the 1970s it had become clear to many relief experts that the standard modes of shelter provision needed to be drastically overhauled—particularly in handling natural disasters.

Enter Cuny, who, in the words of one biographer, was a "take-charge Texan who spent his life chasing trouble."[50] Cuny's first encounter with the world of disaster relief came when he volunteered as a pilot for the Biafran airlifts in 1969. The tragedy had begun two years earlier, when Nigerian forces cut off supplies to secessionist minorities in the country's southeast. Cuny arrived as aid efforts were coming to an end. Troubled by what he'd seen and seduced by the adrenaline rush of disaster-relief work, at the age of 25 he founded his own for-profit consulting firm, Fred Cuny & Associates, later called Intertect. (It sounded better than "Save the Peasants," he once deadpanned.[51])

Less than a year later, Cuny found himself working as an engineering advisor to Oxfam for the Bengali aid operations in East Pakistan (now Bangladesh), where a cyclone had left 300,000 people dead and millions more homeless. The disaster exacerbated the area's political instability, and the country descended into civil war, causing some 10 million people to flee. Arriving at the refugee camps that had sprouted up along the India-Pakistan border, Cuny was appalled by the disorganized tangle of agencies and NGOs that comprised the international community's response. A *Frontline* documentary described his reaction this way:

> For lack of trucks or road repairs, emergency supplies rotted in warehouses while people starved a few miles away. Refugee camps were constructed with no discernible thought to such basic matters as location or sanitation, with the result that some had scant access to water, others were washed away in the first rains, while still others were turned into death camps by cholera epidemics. Especially galling to Fred—the consummate studier of local conditions—was that many relief groups seemed oblivious to the most basic facts about the region and its cultures. One relief agency had distributed heavy woolen jackets, apparently not realizing that East Pakistan was in the tropics with a median annual temperature in the high 70s. Another handed out cans of pork and beans to the hungry, seemingly unaware that the refugees had no way

1972
Polyurethane Igloo
Masaya, Nicaragua
West German Red Cross and Bayer Company
Experimental dome structures provide emergency housing in Masaya, near Managua, Nicaragua, after three consecutive earthquakes strike the area, killing 20,000 people and rendering 250,000 of Managua's 400,000 residents homeless.
Oxfam

1973–76
Habitat for Humanity builds first project
Zaire
Millard and Linda Fuller in Zaire.
The Fuller Center for Housing

of opening the cans, no way of heating the contents, and that neither Muslims nor Hindus ate pork.[52]

Returning from Bangladesh, Cuny began to develop ideas for refugee-camp planning and design. He recognized the importance of sociology in successful relief operations, and believed that better designed camps, which took into account political realities and cultural mores, could save both money and lives. Whereas most camps at the time were designed in a grid, with multiple families housed in military-style barracks, Cuny's design housed victims in single-family tents clustered around open common spaces. Each cluster had its own latrines, cooking areas, and other basic services. With the tightly knit clusters Cuny hoped to encourage ownership, thereby preventing the camp's infrastructure from being over-burdened, which in turn would help prevent the outbreak of disease and allow for better management.

He first tested his ideas in Managua, Nicaragua, in 1972 following an earthquake in the area that left thousands homeless. The results were dramatic. While nearby camps built by the US military experienced a continual surge of refugees, making any attempt at planning a farce, in the camp Cuny designed for Oxfam the population quickly stabilized. Whereas other camps initiated mass inoculations to curb the outbreak of disease, at Oxfam's camp there was no major outbreak of disease and therefore no need for mass inoculations. Likewise, while security issues plagued other camps, at Oxfam's camp cottage industries and self-help organizations sprouted instead. Moreover, Cuny estimated the camp cost 40 percent less to operate than its counterparts.

Calling on many of the design improvements that had permeated development work, over the course of the next 20-odd years Cuny and his associates at Intertect would rethink virtually every aspect of disaster relief and reconstruction. For example, after an earthquake hit Guatemala in 1976, Cuny adapted the self-help model to train families in seismically safer construction techniques. Rather than bulldozing disaster sites, removing debris, and bringing in imported materials as was typically done, he encouraged aid organizations to pay families to clear sites and salvage materials from the rubble to erect temporary and permanent shelter. And instead of handing out tents, he set up programs to provide families with roofing and other building supplies that could later be used for permanent housing.

Oxfam Emergency House-Making Unit in operation following an earthquake in Lice, Turkey, 1975
Oxfam

It was not that Cuny's design ideas were necessarily trailblazing. Others pioneered cluster-based planning, core-housing, and seismically safer construction techniques. Nor was he the only consultant making the connection between disaster and development. But the force of his personality, his ability to implement new approaches under duress, the emphasis he placed on appropriate design, local materials, and labor, his penchant for publishing his ideas, and his role as an independent consultant working with a wide range of agencies made him an ideal catalyst for change. What's more, his military aspirations as a youth (Cuny was a Marine officer candidate before poor grades and a college prank prematurely ended

1975
Oxfam Emergency House-Making Unit
Lice, Turkey

1976
Earthquake
Hebei and Tangshan, China
Leaves 242,419 dead and 182,000 homeless. China refuses international aid.

1976
Earthquake
Guatemala
Fred Cuny works with Oxfam and World Neighbors to design housing "pictographs" to educate Guatemalans in safer building techniques after an earthquake there kills 23,000 people and injures another 76,000.
Fred Cuny/courtesy InterWorks

1976
United Nations Conference on Human Settlements (Habitat)
Vancouver, Canada
Leads to the formation of UN-HABITAT.

Fred Cuny surveys a UN vehicle that was damaged in an attack by gunmen in Mogadishu, Somalia, 1992. Three years later, at the age of 50, he would disappear in Chechnya.
Judy Walgren/Dallas Morning News

his military career) lent him an easy manner with US and other military personnel, giving him access to influential decision makers.

In time Cuny became more involved with "complex emergencies," often in conflict zones. His work began to focus more on the logistics of providing aid and less on design and engineering. However, others carried on where he left off, including consultants such as Ian Davis and Lisa Dubin and groups like Oxfam, CHF, and shelterproject, to name just a few.

Cuny vanished at the age of 50, on a mission to Chechnya in 1995. His body was never recovered and the mystery of his disappearance remains unsolved. While his frank manner bordered on rudeness and his rule-breaking attitude won him as many enemies as friends, Cuny's influence can still be felt. Today, *Disasters and Development*, which Cuny published in 1983, is considered the textbook on postdisaster reconstruction—a fact made all the more remarkable when you consider that it is currently, like most of the works cited here, out of print.

Community Design

Meanwhile, a movement toward greater community engagement was taking shape in the worlds of architecture, planning, and design. Influenced by the failure of many of the large-scale public building projects of the '60s and the rise of the environmental movement, some architects began to see themselves not just as professionals bound to meet the needs of their clients but as stewards of the built environment and advocates for more sustainable development.

In Europe the concept of community design can be traced back to the 1969 Skeffington Report "People and Planning," published in Great Britian. The report accepted the need to involve the public in planning and made far-reaching recommendations that influenced subsequent legislation in the early 1970s. Publicity and consultation became required components of the statutory planning system, providing local people with opportunities to comment on and object to development plans and planning applications.[53] Architects such as Lucien Kroll in Belgium and Giancarlo DeCarlo in Italy actively sought community participation in the design process in an effort to make their designs more responsive to community needs.[54] In England Ralph Erskine based his office in a disused funeral parlor in the center of town during the design of the Byker Housing project in Newcastle-upon-Tyne to encourage residents to drop in talk to with the design team and raise concerns that went well beyond architecture.[55]

By contrast, the nature of the community design movement in America was more political, with roots in the civil rights and social justice movements of the late 1960s and 1970s. In 1968 the civil rights leader Whitney M. Young, Jr., then executive director of the Urban League, opened the hundredth Convention of the American Institute of Architects with these words:

> You are not a profession that has distinguished itself by your social and civic contributions to the cause of civil rights, and I am sure this does not come to you as any shock. You are most distinguished by your thunderous silence and your

1980s

1984–85
Famine
Ethiopia
Drought and political instability lead to food shortages, killing more than one million people.

1985
Earthquake
Mexico City, Mexico
E.V. Leyendecker, National Bureau of Standards

1985–94
Nemausus I & II
Nîmes, France
Jean Nouvel
The architect adapts an industrial aesthetic for the construction of 114 units of subsidized low-cost housing.
Ateliers Jean Nouvel

complete irrelevance....You are employers, you are key people in the planning of our cities today. You share the responsibility for the mess we are in....It didn't just happen. We didn't just suddenly get this situation. It was carefully planned.[56]

According to Rex Curry, former president of the Association for Community Design, the concept for an alternative design practice emerged from this meeting: The Community Design Center (CDC), where volunteer professionals would provide architecture and planning services to nonprofit neighborhood groups free of charge.[57]

During the 1970s there were eighty CDCs sprinkled throughout the country. The centers brought design professionals, environmental engineers, government agencies, and clients together in the design process, usually through a series of workshops, site visits, and interviews. The approach, called "community design" or "participatory design," combined the aspects of self-reliance and self-determination that made the self-help model so compelling with the same emphasis on design, technical expertise, and sustainability usually provided to private clients.

It was a way of working that came naturally to Samuel Mockbee. Mockbee studied architecture at Auburn University in Alabama and developed his ideas and aesthetic while in private practice in Mississippi, first in partnership with Thomas Goodman in 1977, then with Coleman Coker and Tom Howorth starting in 1983. He became interested in low-income housing in 1982 when he helped a Catholic nun move and renovate condemned houses in Madison County. He built his first "charity house" there for $7,000 using donated and salvaged materials and volunteer labor—a model he would later develop with his students.

In 1993 Mockbee returned to Auburn University and founded the Rural Studio with D. K. Ruth. For Mockbee the studio was a means of combating the entrenched discrimination, substandard housing, and poverty he saw around him, while giving architecture students hands-on experience missing from most curriculums. The homes the Rural Studio built were as exuberant as they were intensely customized. Like Mockbee's earlier work, they were the physical embodiment of a conversation between architect and client. It just so happened that in this case the clients were living on the poverty line in rural Alabama—people, as Mockbee described them, "left over from Reconstruction." What made his approach radical was not that Mockbee treated these prospective homeowners with hard-won dignity and respect, though he did, but that he treated them as *clients*. As he wrote:

> The professional challenge, whether one is an architect in the rural American South or elsewhere in the world, is how to avoid being so stunned by the power of modern technology and economic affluence that one does not lose sight of the fact that people and place matter....
>
> For me, these small [Rural Studio] projects have in them the architectural essence to enchant us, to inspire us, and ultimately, to elevate our profession. But more importantly, they remind us of what it means to have an American architecture without pretense. They remind us that we can be as awed by the simple as by the complex and that if we pay attention, this will offer us a glimpse into what is essential to the future of American Architecture: Its honesty.
>
> "Love your neighbor as yourself." This is the most important thing because nothing else matters. In doing so, an architect will act on a foundation of decency which can be built upon. Go above and beyond the call of a "smoothly functioning conscience", help those who aren't likely to help you in return, and do so even if nobody is watching![58]

These were also buildings that one could describe in the highbrow language of architecture. That, too, was a revelation. With its meager

"The main difference between success and failure is the degree to which poor people themselves are involved in determining the quality and quantity of the services they receive."

***World Development Report*, World Bank, 2004**

1989
Aranya Community Housing
Indore, India
Balkrishna Doshi, Vastu-Shilpa Foundation
Vastu-Shilpa Foundation

1989
Loma Prieta Earthquake
Watsonville, Calif., USA
One in five victims camps outside his or her home rather than use the officially designated communal shelters.

1990–91
Improved Quincha Earthquake-Resistant Housing
Alto Mayo Region, Peru
ITDG
Developed in response to the earthquake that struck in 1990, the design improves upon traditional Quincha building methods [in which walls are constructed from wooden poles infilled with smaller wooden poles] by adding roof trusses and making them more flexible and

budgets and scavenged materials, the Rural Studio had invented a new palette. Curtain walls were constructed from car windshields, columns from carpet tiles, yet nothing about the structures appeared recycled. There was certain poetry to their form that demanded—and received—critical respect.

Humanitarian Design Today

During the 1980s and 1990s others also worked to bridge the gap between providing basic shelter and building sustainable communities. In 1983 architect Balkrishna Doshi laid the foundations for what would become a vibrant, mixed-income neighborhood in Indore, India, by combining the best of the sites-and-services and self-help housing models with a more heightened design sense.

The project, which was undertaken by the Vastu-Shilpa Foundation (founded by Doshi himself), included 80 demonstration homes and an urban plan for a new mixed-income township in Aranya near Indore, India. With funding from the World Bank, the architect replaced the unsympathetic grid layout of the typical sites-and-service scheme with a cluster-based plan. The demonstration homes, which Doshi designed around a basic service core, included balconies, patios, and other harmonizing details. The project was intended to encourage new owners to expand their homes progressively as time and money allowed and to embellish them according to their tastes. In a testament to the project's success, by 1989 Doshi's original demonstration homes were selling for 10 times their original price.[59] The foundation later pursued an even more participatory approach in the reconstruction of Ludiya, in Gujarat, India after an earthquake hit Gujarat in 2001.

Other projects that incorporated a more sensitive approach to community development included low-income housing designed by Yasmeen Lari in Pakistan; the Alexandra Townships Housing project designed by Jo Noero in South Africa; and the work of Jan Wampler in Puerto Rico.

The 1980s also saw a renewed interest in adapting technology to better meet the needs of communities. In Canada John Todd and the New Alchemists designed ways of treating waste naturally on-site using plant life (see "Living Machine"). In parts of the developing world ITDG (Intermediate Technology Development Group), founded

"Everybody wants the same thing, rich or poor...not only a warm, dry room, but a shelter for the soul."

Samuel Mockbee, architect

Samuel Mockbee (center) with Anderson Harris (right) and family. In 1997 the Rural Studio would build the Harrises a home, affectionately called the Butterfly House, and in return the Harrises would donate land for the Mason's Bend Chapel.
Timothy Hursley

therefore more earthquake resistant. In 1991 another quake destroys 17,000 homes, but the 70 locally built improved structures withstand the tremor, demonstrating the effectiveness of the design and prompting the group to build another 4,000 homes.

1993
Mississippi River Flood
Midwestern USA
American Red Cross spends $44 million to help families recover. FEMA creates initiative to buy or relocate properties to prevent future flood losses.

1993
Rural Studio
Newburn, Ala., USA
Samuel Mockbee founds the Rural Studio at Auburn University.

1994
Rwandan Genocide
Burundi, Rwanda, Tanzania
Interahamwe Hutu extremists kill an estimated 500,000 to 800,000 Rwandans in 100 days. Two million refugees flee the country. The outbreak of disease in refugee camps claims an additional 80,000 lives.

in 1965, worked to improve the everyday life of large numbers of people by investing in small technological improvements, such as more energy-efficient stoves or earthquake-resistant adaptations of vernacular housing. The idea of technology for technology's sake gave way to the concept of "appropriate" technology.

However, for every project that pushed the boundaries of socially responsible design, there were many others that relied on formulaic solutions or excluded the community from the planning and design process. In the 1970s planners had responded to new statutes requiring public participation with enthusiasm, putting time and effort into preparing exhibitions and organizing community workshops. Yet public response was often disappointing, and this led many planning authorities to reassess their commitment and to carry out only the minimum work necessary. Public housing programs experienced drastic funding cuts, and in America many community design centers, which had relied on federal funding, shut down.

Likewise, disaster reconstruction efforts were equally varied. Two catastrophic earthquakes in particular demonstrated the extremes of response: The first was the 1985 Mexico City earthquake, which killed nearly 5,000 people and left 200,000 homeless. The second was the Hanshin earthquake that struck the industrial city of Kobe, Japan, in 1995, killing 6,300 people and leaving 100,000 homeless. Both disasters hit densely populated urban areas. However, Mexico City largely recovered after two to three years, while recovery in Kobe took substantially longer. According to Mary Comerio, who analyzed both disasters in her book *Disaster Hits Home*, the difference had as much to do with design and planning as it did with economic factors and politics.[60]

The Mexico City quake measured 8.1 on the Richter scale and lasted approximately two minutes. It leveled 2.3 square miles [6 sq. km] in the historic center of the city, which also happened to house the city's government buildings. A second quake the next day compounded the loss of life and material damage. More than 600 buildings completely or partially collapsed. Hardest hit were the city's *viviendas*, or low-income neighborhoods, where most occupants were renters rather than owners.

Because these residential buildings earned extremely low rents and almost none was covered by insurance, it was clear from the beginning that property owners would have little incentive to rebuild. Yet residents lobbied aggressively to stay in their neighborhoods. With funding from the World Bank and loans and concessions from the International Monetary Fund, Mexico responded by establishing a number of housing programs, the largest of which, Renovación Habitation Popular, was mandated to build or repair more than 48,000 housing units.

This ambitious undertaking combined the best of neighborhood-level community design with a government-administered housing program. Under the program, displaced residents in renewal areas were given a Certificate of Rights, which entitled them to low-interest loans to buy rebuilt units, thus converting them from tenants to owners. Residents lived in temporary metal sheds in public streets, parks, alleys, and other rights-of-way near their damaged homes while they worked with their neighbors to repair their community.

After an earthquake struck Gujarat, India, in 2001, the Vastu-Shilpa Foundation facilitated a community-led effort to reconstruct the village of Ludiya. Here, residents outside their newly rebuilt homes.
Vastu-Shilpa Foundation

1995
Hanshin Earthquake
Osaka Bay, Japan
Dr. Roger Hutchison/National Geophysical Data Center

2000s

2001
Earthquake Reconstruction
Ludiya, Gujarat, India
Vastu-Shilpa Foundation

2004
Tsunami
Indian Ocean
175,000 people are killed and more than one million people in 13 countries are displaced.

Reconstruction plans were developed by community members aided by technical specialists, including some 280 architectural and engineering firms, and were based on a prototypical two-bedroom apartment unit in a three-story building with a single entrance gate. According to Comerio, by standardizing the building design, the city was able to process as many as 800 building permits a month and a single team of inspectors could monitor construction.[61]

In total the government repaired or built nearly 88,000 housing units over the course of two years. "Neighbors together with their neighbors animated by healthy solidarity, organized spontaneously and efficiently, were able to save lives, put an end to misfortune, rebuild the city and create a promising future," wrote a reporter for the newspaper *Excelsior* in a retrospective published 13 years after the disaster.[62]

By contrast, recovery from the earthquake in Japan took 10 years and exposed large gaps in the social net of one of the world's most developed countries.[63] With a population of 1.5 million, Kobe was Japan's sixth-largest city and the world's sixth-largest port. Although more than 90 percent of the damaged structures were residential, the city's economic importance meant that its commercial infrastructure was the first to come back on line. In the disaster's aftermath the government built 48,000 temporary housing units in parking lots and on undeveloped land and filled them with displaced residents by lottery. Two years later thousands of people still lived in metal crates in temporary camps sited on the city's outskirts.[64]

Kobe's slower recovery can be attributed to a number of factors. Before the quake Japan had no emergency-response system for natural disasters. A reliance on the private market to recover losses also contributed to the slow pace of rebuilding. Also, many blamed the decision by city authorities to place temporary housing outside residents' former neighborhoods, hindering families from returning to work, isolating them from their social networks, and preventing them from tapping local resources to solve their own housing crises.[65] But by far the biggest failure was that of the international aid community and officials in Japan to learn from the mistakes and success of other cities in coping with disaster.

In the years following the Mexico City and Kobe earthquakes, a series of floods, hurricanes, and other disasters did prompt local officials in some cities to take disaster mitigation measures. New codes forced owners to retrofit unreinforced masonry buildings, bolt structures to their foundations, install roof ties, build to higher flood elevations, and take other steps to strengthen buildings in disaster-prone cities throughout the United States, for example. Recognizing the role of environment in mitigating disasters, some cities, most notably Tulsa, Oklahoma, also implemented land-use controls, such as protecting important wetlands and preventing development in areas vulnerable to natural disaster.

Conclusion

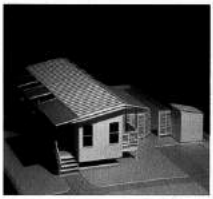
A century after the San Francisco earthquake, the solution to housing the world's displaced and disenfranchised remains as stubbornly situation-specific and complex as ever. Even as we compiled this book, a series of tsunamis, hurricanes, and earthquakes reminded the world once again how vulnerable and unprepared we are against the awesome powers of nature—whether we live in the world's poorest country or its wealthiest. The Red Cross estimates that over the past two decades, on average more than 75,000 people have been killed annually by natural and manmade disasters, and another 211 million have been affected by disaster each year—more than 98 percent of them in the developing world. What's more, the agency reports that over the last decade the number of disasters—and the number of people affected by disasters—has climbed.[66]

Likewise, systemic substandard housing conditions continue to plague the world's cities. UN-HABITAT estimates that nearly one billion people, a third of the world's urban population, live in slums. The agency projects that number will double by 2030.[67]

Fortunately, we also live in a time when technology, particularly the ubiquitous Internet, has enabled the rapid exchange of ideas on an unprecedented scale. Groups such as Slum Dwellers International are using the Web to network and exchange models of development between slum dwellers in different countries. CAD software has made professional design services more affordable and enabled architects to volunteer their services in communities near and far. At the same time, computer modeling systems have led to technical advances promoting safer, more disaster-resistant building design.

2005
Operation Restore Order
Zimbabwe
Pres. Robert Mugabe orders a crackdown on "illegal structures," forcing slum dwellers to tear down their own dwellings throughout the country. Nearly 600,000 people are left homeless. UN-HABITAT condemns the slum-clearance program as indiscriminate, unjustified, and conducted with indifference to human suffering.

2005
Green Mobile Home
Mississippi State University, Mississippi State, Miss., USA
Developed by architects at the Carl Small Town Center, part of the College of Architecture, Art, and Design at Mississippi State University, this self-sufficient, solar-powered unit was designed as an alternative to the traditional mobile home.
Jason Pressgrove and Michael Berk



2005
Hurricane Katrina
Louisiana, Mississippi, Alabama, USA
145-mph winds tear a path of destruction through the Gulf Coast. The storm and subsequent flooding of New Orleans kill an estimated 1,325 people; more than one million people are displaced from the Gulf Coast region. Emergency officials respond by bringing more than 50,000 travel

The Engineering Unit of the Thai Army erected temporary housing in Ban Nam Kaem, Takua Pa province, Thailand, following the Indian Ocean tsunami of December 2004.
Roslan Rahman/AFP/Getty Images

A wider appreciation for the importance of design in disaster mitigation and community development has spurred greater collaboration between designers and communities. In addition to the many architects and groups engaged in community design and development profiled in this book, organizations such as the Aga Khan Development Network, Architects Without Frontiers, Architecture + Development, Architectes de l'Urgence, the Buckminster Fuller Institute, Builders Without Borders, Building and Social Housing Foundation, Association for Community Design, Architects/Designers/Planners for Social Responsibility, the Enterprise Foundation, Design Corps, Design Matters, Public Architecture, Shelter Associates, shelterproject, World Shelters, the Volunteer Architects' Network, and many others have emerged, promising a more innovative and inclusive approach to designing shelter.

Will the start of the twenty-first century be remembered as the golden era of socially conscious design? The answer will likely depend on the willingness of architects and designers to reach beyond the design community and its traditional audience—to humbly venture into the communities in which they live, listen to the needs of their neighbors, and offer their services. As Samuel Mockbee once said: Proceed and be bold.

trailers and mobile homes to the area, but 100 days after the disaster, demand continues to outstrip supply. At right, FEMA tag on the door of a home in New Orleans indicates it has been searched for survivors.
Win Henderson/FEMA

2005
Earthquake
Pakistan-administered Kashmir
A month after the disaster the death toll estimate stands at 87,000; more than two million people are displaced. The United Nations exhausts its stockpile of tents. At right, desperate families in Muzaffarabad, Pakistan, set up a camp using recycled advertising billboards in an attempt to shelter themselves as winter approaches.
David Guttenfelder/AP Photo

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3 Philip L. Fradkin, *The Great Earthquake and Firestorms of 1906*, Berkeley: University of California Press, 2005, 209.
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6 Ibid., 84.
7 Ibid.
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18 "The Mail-Order House," *CBS News Sunday Morning*, Aug. 24, 2003, http://www.cbsnews.com/stories/2003/05/14/Sunday/main553963.shtml.
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20 Sandra Rihs and Daniel Katell, "The Evolution of Slum Clearance Policies in London and Paris," United Nations Centre for Human Settlements (UN-HABITAT), vol. 7, no. 3, Sept. 2001.
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22 Kerry D. Vandell, "FHA Restructuring Proposals: Alternatives and Implications," *Housing Policy Debate*, Fannie Mae Foundation, vol. 6, issue 2, 1995, 299–394.
23 Charles Abrams, *The Future of Housing*, New York: Harper & Brothers, 1946.
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26 Robert Rubin, "Jean Prouvé," Yale School of Architecture, 2005, http://www.architecture.yale.edu/tropical_house/essay.htm.
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34 "Slums: The Magnitude of the Problem," Tata Institute of Fundamental Research, http://theory.tifr.res.in/bombay/amenities/housing/slum-stats.html.
35 Abrams, *The Future of Housing*, 129.
36 The first "self-help and mutual aid" project in America took place in the coal-mining areas of Pennsylvania during the Depression. In the wake of mass unemployment at the mines, the program sought to bring unemployed mine workers living in slum conditions "back to the farm" by paying them to build their own housing. Peter M. Ward, *Self-Help Housing: A Critique*, London: Mansell, 1982, 26.

37 Hassan Fathy, *Architecture for the Poor*, Chicago: University of Chicago Press, 1976, 32.
38 Ibid., passim.
39 Roberto Chavez, Julie Viloria, and Melanie Zipperer, "Interview with John F. C. Turner," World Bank forum, Washington, DC, April 2–3, 2002, www.worldbank.org/urban/forum2002/docs/turner-excerpt.pdf; Ward, *Self-Help Housing*, 23.
40 Robert William Stevens and Habitat for Humanity, eds., *Community Self-Help Housing Manual: Partnership in Action*, Croton-on-Hudson, NY: Intermediate Technology Development Group of North America, 1982.
41 It was intended that the squatter community help defray the costs of the new services by paying for water usage and other services and by repaying their loans. Ultimately, though, many residents were slow to pay their loan installments and resented being charged for services. If wealthy Lusakans did not have to pay for them, they argued, why should they, especially when they received much lower levels of service (for example, trash was often not collected at all in the project area). Nonetheless, the program was considered a success and offered an alternative approach for cities struggling with an explosion of squatter settlements. "Lusaka Sites and Services Project," Upgrading Urban Communities, The World Bank Group, 1999–2001, http://web.mit.edu/urbanupgrading/upgrading/case-examples/ce-ZA-lus.html.
42 Nabeel Hamdi, *Housing Without Houses: Participation, Flexibility, Enablement*, London: Intermediate Technology Publications, 1995.
43 Ibid., 20.
44 Ward, *Self-Help Housing*.
45 Turner and Fichter, *Freedom to Build*, 147.
46 During the 1920s–30s a series of disasters (including the Mississippi River flood of 1927, which inundated an area almost as large as New England and left 700,000 people homeless, and the Long Beach, California, earthquake of 1933, which caused a number of school buildings to collapse) prompted the United States Congress to pass a number of flood control measures and other legislation aimed at disaster-mitigation and relief. The Reconstruction Finance Corporation gave disaster loans for repair and reconstruction of certain public facilities. The Flood Control Act gave the US Army Corps of Engineers greater authority to build levees and implement other flood control projects, and by 1934 the Bureau of Public Roads was given the authority to provide funding for highways and bridges damaged by natural disasters. Still, as in most countries, disaster recovery was funded on an incident-by-incident basis, and assistance to individuals was considered largely the domain of voluntary agencies and private charity. Congress did not establish a coordinated disaster relief program until the 1950s. "FEMA History," Federal Emergency Management Agency, Oct. 23, 2004, http://www.fema.gov/about/history.shtm.
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48 Ian Davis, telephone interview with Kate Stohr, June 13, 2005.
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57 Bryan Bell, ed., *Good Deeds, Good Design: Community Service Through Architecture*, New York: Princeton Architectural Press, 2004, 63.
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Doshi designed a master plan and model homes for an innovative mixed-income sites-and-services development. Homes, which include balconies and look onto a shared courtyard, are grouped in clusters of ten along a central spine. Septic tanks are provided for each group of 20 houses, and electricity and water are available throughout. The new development will eventually house a population of 60,000.

60 Mary C. Comerio, *Disaster Hits Home: New Policy for Urban Housing Recovery*, Berkeley: University of California Press, 1998, 128.
61 Ibid., 142.
62 Manuel Magaña Contreras, "The Greatest Catastrophe Ever Suffered by Mexico City," *Excelsior*, Sept. 20, 1998, http://www.tenorissimo.com/domingo/Articles/excel92098.htm.
63 Toshizo Ido [governor of Hyogo Prefecture], "Learning to Live with Risk," World Conference on Disaster Reduction, Kobe, Japan, Jan. 18, 2005.
64 Michael Zielenziger, "Kobe Still Reels from Earthquake; Many are Homeless; Government Lags," *San Jose Mercury News*, Jan. 20, 1997, 1A.
65 Davis, interview with Stohr.
66 Between 2000 and 2004 disasters affected one-third more people than between 1995 and 1999. International Federation of the Red Cross, *World Disasters Report 2005*, table 3, 196.
67 "Millennium Development Goals," 2003, UN-HABITAT, http://www.unhabitat.org/mdg/.

4.1 The needs and resources of survivors

Principle

The primary resource in the provision of post-disaster shelter is the grass-roots motivation of survivors, their friends and families. Assisting groups can help, but they must avoid duplicating anything best undertaken by survivors themselves.

Audience

Private sector:
Manufacturers/contractors

Professionals:
Architects/planners/engineers

Policy-making administrators:
National (tertiary) level

Project managers of post-disaster shelter/housing projects:
Regional/provincial (secondary) level

Time phases

Pre-disaster phase
Preparedness/mitigation/
risk reduction

Phase 1
Immediate relief period
(impact to day 5)

Phase 2
Rehabilitation period
(day 5 to 3 months)

Phase 3
Reconstruction period
(3 months onward)

Response

In the disasters studied, the primary response to shelter needs has been provided by the survivors themselves. The secondary response has been that of local organizations, particularly those in place at the time of the disaster. The least effective response has inevitably come from expatriate organizations with no prior experience of the disaster-affected area. In no case have these organizations provided more than 20 per cent of the local shelter response. This percentage relates to both shelter units and materials provided in the emergency phase.[12]

The factors limiting the participation of external assisting groups include:

1. **Time**
External organizations cannot move fast enough to participate fully during the emergency period. It is not only extremely difficult to mobilize external resources quickly, but the enormous problems of shelter distribution in the stricken area limit the possibility of delivery within the emergency period.

2. **Scale of disaster**
The magnitude of many disasters, especially in relation to numbers affected and the cost of meeting their needs, clearly prohibits any major role for imported shelter. No expatriate agency has the resources to meet the massive needs which can be, and are, more often best met by local resources.

3. **Self-reliance**
The peoples of developing countries are more self-reliant in the basic skills of shelter construction than their counterparts in the industrialized countries. This is particularly true in rural areas where, in any case, families have always built their own houses. If the nature of the disaster allows them to stay in place, they can, in principle, rebuild their homes quickly, although they may require technical and material assistance.

Availability of building materials

In every type of disaster and post-disaster situation, a wide variety of building materials is available for emergency shelter and housing reconstruction programmes.[13]

Following every type of disaster, one or more of the following sources can be used to obtain substantial amounts of the materials needed for construction:

— Inventories of unused materials that existed before the disaster.

— Indigenous materials (both commercially and non-commercially available).

— Materials salvaged from the rubble.

12. The ratio of locally provided shelter to external provision bears out be statistics issued by the Office of Foreign Disasters Assistance of the United States Government indicating that, in a ten year period (1965–1975), for every dollar provided in disaster assistance from external sources, 42 US dollars were provided within the countries affected. [Committee on International Disaster Assistance (CIDA) The United States Foreign Disaster Assistance Programme National Academy of Sciences, Washington D.C., USA, 1978.]

13. Even in international refugee situations, where the refugees themselves may not have access to the normal housing materials supply market, the host government and supporting international and voluntary agencies will have access to local resources for emergency shelter and housing.

Of the above, the latter two are the most important for widespread housing programmes. The vast majority of the urban poor usually rebuild from materials obtained from non-commercial sources. Housing in rural areas is most likely to be based on indigenous materials. Industrially manufactured building materials are those which normally survive a disaster in the best condition and are, therefore, the best to salvage from the rubble.

In studying the major disasters which have occurred during the past ten years, causing extensive housing losses, it has been found that there have been enough resources from indigenous and salvaged materials to rebuild nearly three-quarters of the housing to pre-disaster standards. Indeed, for houses rebuilt to a structurally safer standard, the same materials can be used in over 90 per cent of cases, thereby substantially reducing the costs of reconstruction. Yet, authorities and agencies responsible for handling relief and reconstruction efforts have repeatedly overlooked these resources, and have often, and inadvertently, taken steps to destroy them.

The reasons are:

— That few assisting groups have prior housing or building experience and, therefore, are not familiar with the types of materials required or available.

— That indigenous and salvageable materials are often overlooked when the authorities or assisting groups reject pre-existing building standards.

— That housing is often over-emphasized by assisting groups, though, as will be seen throughout this study, it is not always the highest priority item for low-income families in a developing country. They may not, therefore, be willing to invest substantial amounts of money, time or effort into building formal structures.

These problems indicate the need:

1. To understand the local building process which exists before a disaster. The most effective assisting group will be one which is conversant with the pre-existing norm, and draws upon this understanding in the development of the post-disaster programme.

2. To survey resources available after the disaster. This will probably require the employment by assisting groups of personnel with experience of local building traditions.[14]

14. In India in 1971, at the beginning of relief operations for the East Bengali refugees, none of the major agencies involved had any prior housing experience in India. At the peak of the influx of refugees in August 1971, only three of the ten largest agencies employed housing or emergency shelter specialists. Over the years, the situation has not significantly improved : in reconstruction operations in Guatemala, 1976, out of the forty agencies involved in reconstruction, only five had had prior housing experience in Guatemala; and of the remainder, only seven had staff with prior low-cost housing experience. Reconstruction of Housing in Guatemala: A Survey of Programs Proposed after the Earthquake of February 1976, Charlotte and Paul Thompson, UNDRO/Intertect, 1976.

Table 1
Shelter priorities of disaster survivors relative to roles of assisting groups

Preferences of disaster survivors in order of priority	International agencies	External donor governments	External Voluntary Agencies	Foreign experts	Local military	National government	Local administration	Local voluntary groups	Survivors	Examples of this preference
Remain as close as possible to damaged or ruined home									X	Guatemala 1976
Move into the home of family or friends									X	Skopje, Yugoslavia 1963; Managua, Nicaragua 1972
Improvise temporary shelters close to ruined home									X	Guatemala 1976; Peking alert, China 1976
Occupy buildings temporarily requisitioned							X	X	X	Van, Turkey 1976
Occupy tents near ruined home					X		X	X	X	Gediz, Turkey 1970; Lice, Turkey 1975; Van, Turkey 1976
Occupy emergency shelters provided by external agencies	X	X	X			X	X			Chimbote, Peru 1970; Gediz, Turkey 1970; Managua, Nicaragua 1972; Lice, Turkey 1975
Occupy tented camp sites	X	X	X							Guatemala 1976
Compulsory evacuation to distant locations					X	X				Managua, Nicaragua 1972

Survivors' priorities

(See table 1)

Survivors show certain distinct preferences for their shelter in the aftermath of disaster. The evidence suggests that their priorities are:

1. To remain as close as possible to their damaged or ruined homes and their means of livelihood.
2. To move temporarily into the homes of families or friends.
3. To improvise temporary shelters as close as possible to the site of their ruined homes (these shelters frequently evolve into rebuilt houses).
4. To occupy buildings which have been temporarily requisitioned.
5. To occupy tents erected in, or next to, their ruined homes.
6. To occupy emergency shelters provided by external agencies.
7. To occupy tents on campsites.
8. To be evacuated to distant locations (compulsory evacuation).

A key function of emergency shelter is the storage of salvaged belongings. This photograph was taken after the Guatemalan earthquake of 1976.

OXFAM

Functions of shelter

Emergency shelter serves several vital functions (not listed in order of priorities):

- Protection against cold, heat, wind and rain.[15]
- Storage of belongings and protection of property.
- The establishment of territorial claims (ownership and occupancy rights).
- The establishment of a staging point for future action (including salvage and reconstruction, as well as social reorganization).
- Emotional security and the need for privacy.
- An address for the receipt of services (medical aid, food distribution, etc.).
- Shelter within commuting distance of employment. Accommodation for families who have temporarily evacuated their homes for fear of subsequent damage.[16]

15. Evidence from two severe winter earthquakes (Van, Turkey, 1976 and Southern Italy, 1980) shows how families take the initiative in reducing the risks of exposure, by lighting fires made from earthquake debris, digging in to form semi-underground structures, thus securing ground warmth; or by erecting several tents inside each other to form a cellular insulation skin. This shows that the majority of survivors who are frequently from the poorest sections of the community are the most resourceful. See Ressler, Everett. Issues Related to the Provision of Emergency Shelter in Winter Conditions (Report on visit to Caldivan Earthquake, Eastern Turkey). UNDRO/Intertect, 1977.

16. A major earthquake and its aftershocks may result in families needing temporary accommodation for a long period. Normally this form of shelter will be adjacent to their homes, with many activities still taking place inside the house but sleeping occurring in cars, tents or improvised shelters. Following the 1976 Friuli earthquake in Italy, many families with undamaged, or partially damaged homes moved out into temporary accommodation. Whilst this occurred, a second earthquake took place, causing additional damage to the already weakened structures but minimal loss of life due to evacuated houses. A further effect of earthquakes is that, in certain instances, surviving families have shown reluctance to begin salvaging materials from the rubble until the threat of a secondary disaster has passed. In the case of floods, families will be displaced for as long as it takes the flood waters to retreat. On their return, the problems of inundated soil, contaminated water supply etc., normally delay the repair or reconstruction of buildings.

Improvised shelters in Guatemala, made from any waste materials: cardboard boxes, earthquake rubble, etc.

Policy guidelines
Policies to avoid

1. Actions which duplicate the efforts of survivors.

2. Bulldozing rubble and burning timber from damaged houses, which could otherwise be recycled into new homes.

3. Importing labour for reconstruction when there is ample labour to be found locally.

4. Importing building materials which can be obtained locally.

5. Compulsory evacuation, especially of women and children: although this can temporarily reduce the pressure on local resources, it can cause social misery and apathy.

6. Relocation of survivors on land which is remote from work, markets, schools and other social and economic needs.

7. Creating large emergency campsites with risks of adverse social and environmental effects.

8. Building imported or prefabricated temporary shelters unnecessarily.

Policies to adopt

Encouragement of people to participate in the assessment of their own needs and resources

The objective is to minimize dependency on outside support, and concentrate official effort on identifying gaps and unmet needs with survivor participation. Advice on local housing needs is best obtained from local builders, architects or engineers. In some situations there may be local housing institutions with knowledge of building traditions and resources. Official groups, such as local government housing officers and public works departments, will have knowledge of the local housing process. Advice on how to make low-cost housing safe against future hazards may need to be introduced, but there is normally a shortage of local expertise on this subject.

Provision of materials and tools

Establish programmes which make shelter materials available, such as blankets, plastic sheeting, roofing sheets, and locally available or traditional building materials. In addition, tools for building and clearing rubble are always needed.

In cold climates or seasons, keeping stocks of robust *winterized* tents

This policy should be balanced against others advocated in this study: in many instances where the climate is mild or warm, alternative strategies can be adopted to mobilize local resources for rapid reconstruction.

Provision of transport for voluntary evacuation

Families wishing to leave the affected area to stay with friends or relatives who can receive them temporarily, should receive transport.

Requisition of public or community buildings

Public buildings such as schools, churches, community halls etc. can fulfil an important function in providing emergency accommodation for homeless families. Such buildings should be earmarked and checked by qualified civil engineers for their structural resistance to the prevailing natural hazards. The maximum magnitude of hazard against which to check these buildings should correspond to the expected magnitude of hazard for a return period equivalent at least to the economic life of the building in question.

Cash grants and sale of building materials

Where stockists are still functioning, the provision of cash grants, or low-interest loans to enable survivors to buy building materials and tools, can be a highly effective policy. However, prior to embarking on such programmes, assisting groups must ascertain the scale of needs in relation to local resources: a small community may be able to obtain adequate supplies from normal stockist, but in a major disaster shortages may rapidly occur with consequent price rises.

Where the supply of materials or tools is limited, assisting groups, including the local government, should negotiate the block purchase of supplies and organize their transport and distribution to the affected area. Various approaches have been adopted to control the prices of essential materials (such as governmental price controls), but these interventions in a market economy may result in further shortages unless it is financially advantageous to the private sector to increase supplies or production substantially.

It should be noted that the distribution of essential shelter supplies is more effective if they are sold rather than given away, though subsidies may be necessary in

cases of severe hardship. Although assisting groups may find selling more complicated than free disposal, it is better for the following reasons:

— It retains the dignity of the survivor, who will be a participant rather than a victim, if he purchases goods himself.

— Free distribution creates problems of dependency.

— Free distribution can have serious adverse effects on local stockists trying to sell their goods in a normal manner (they themselves may also be victims of the disaster).

— The money from the sale of shelter goods is needed by agencies for other vital purchases.

Although it is better to offer loans than to make outright cash grants, there are nevertheless certain instances when cash grants may be an important and effective form of aid:

— To near destitute people, where they form so small a percentage of the population that they will not significantly drive up prices of commodities.

— To labourers, in lieu of wages lost following disaster, in order to enable them to salvage belongings and materials, and build shelters, or begin to reconstruct their homes.

— To poor artisans, to replace destroyed equipment essential to their livelihood; also possibly in lieu of income lost as a result of goods destroyed or damaged in the disaster.

— To low income groups across a wider spectrum, when essential commodities are available in abundance in nearby, unaffected regions, and where the cash grant is in effect a subsidy for the part of the price which traders add for increased transport costs.

— Access to land for housing and resettlement.

Authorities frequently hold the key to rapid recovery, and must recognize the need to make land available. Ideally such land should be as close as possible to original homes and means of livelihood, but in a less hazardous area. Inevitably this will require loans or subsidies since the new land will require purchase and development (see Chapter 5).

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Summary of significant developments over the past 30 years

During this period the role of the disaster affected in managing their own shelter and other aspects of their recovery has become increasingly significant, due to various factors:

— The use of mobile phones to request support from friends and relatives and thus enabling surviving families to purchase shelter materials and tools themselves.

— The scale of certain massive disasters (2004 Indian Ocean Tsunami, 2005 Pakistan Earthquake, 2010 and 2011 Pakistan Floods, 2010 Haiti Earthquake) stretched national and international resources to the limit and beyond, thus requiring more extensive ad hoc responses by surviving communities.

— *The Code of Conduct of the International Red Cross and Red Crescent Movement and NGO's in Disaster Relief*[17] has had a significant impact in placing priority emphasis on the needs of disaster affected population with more than 500 signatory organizations.

— A growing awareness of the different values and interests of assisting groups and recipients. Disaster affected populations have many priorities including the need for shelter and other basic requirements. At the same time, individuals, agencies, governmental departments and manufacturers who offer assistance also have their own priorities (publicity, political manifestos etc.). Sometimes the pressures are balanced (e.g. provision of basic building materials at no or low cost benefits both the disaster affected and the private sector), while in other situations there are sharp conflicts between them. For example, conflict can arise in situations of resettlements, when the disaster affected prefer to continue living near their original dwelling for livelihood purposes. Finally, these pressures can sometimes be unbalanced (e.g. disaster affected population are able to organize their own shelter provision, however, there will always be a need for much larger scale work by other sectors.).

— Most international bodies and NGOs now regard shelter and dwelling reconstruction as a development rather than a relief and *welfare issue*. With typical characteristics of a welfare approach being replaced by those more often seen in development programmes. For instance, there is more facilitation of programmes as opposed to agencies directing programmes. The affected population are being encouraged to assess their own shelter needs rather than external assessments being carried out. The disaster affected are more often being regarded as *active survivors* in organizing their own sheltering or reconstruction rather than *passive victims* needing support. Where disaster affected used to have minimal participation in the reconstruction process and the overall stance was seen as one off hand outs of free shelters, survivors are now fully participating in their recovery and where possible pay in cash or kind for their own shelter.

17. IFRC. ***Code of Conduct of the International Red Cross and Red Crescent Movement and NGO's in Disaster Relief Geneva***, 2011. Available at: http://www.ifrc.org/en/publications-and-reports/code-of-conduct/

— Finally, training opportunities for the disaster affected are widely offered by assisting groups for any activity that supports recovery and are grasped at all levels.

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4.6 Shelter Strategies

Principle

Between emergency shelter provision and permanent reconstruction there lies a range of intermediate options. However, the earlier the reconstruction process begins, the lower the ultimate social, economic and capital costs of the disaster.

Audience	Time phases
Private sector: Manufacturers/contractors	**Pre-disaster phase** Preparedness/mitigation/risk reduction
Professionals: Architects/planners/engineers	**Phase 1** Immediate relief period (impact to day 5)
Policy-making administrators: National (tertiary) level	**Phase 2** Rehabilitation period (day 5 to 3 months)
Project managers of post-disaster shelter/housing projects: Regional/provincial (secondary) level	**Phase 3** Reconstruction period (3 months onward)

“SHELTER STRATEGIES”
IFRC and OCHA

Options

In the light of the obstacles posed to *emergency shelter*, this section examines alternative shelter strategies, and proposes corresponding policy guidelines.

1. **Tents;**
2. **Imported designs and units;**
3. **Standard designs incorporating indigenous materials;**
4. **Temporary housing;**
5. **The distribution of materials;**
6. **Core housing;**
7. **Hazard-resistant housing;**
8. **Accelerating reconstruction of permanent housing.**

1. Tents

The tent is often viewed as the most obvious form of emergency shelter, and remains an effective and flexible relief item, especially when compared to the many alternative forms that have been tested and failed. The tent will therefore continue to survive as a major resource.

a. Tents have certain characteristics which have made them very popular:

i. They are relatively lightweight, compact, and easy to transport;

ii. They can be erected rapidly and easily;

iii. They are the only form of disaster shelter that is stockpiled by donor countries and relief agencies in readiness for the potential demand.

b. They are similarly popular with the governments of affected countries for certain additional reasons:

i. They are normally stockpiled by the army and can be quickly released for disaster survivors;

ii. Unlike improvised settlements, they are unlikely to become permanent, since they possess built-in obsolescence;

iii. They are a visible demonstration that authorities are taking action to help the homeless.

c. However, despite the obvious necessity for, and effectiveness of, tents in certain situations, such as severe winter conditions, they have a number of limitations:

i. They fail to fulfil some essential shelter functions. They are not suitable for storage of salvaged goods, belongings and animals.

ii. They are frequently too small for a family’s needs, and are impossible to extend;

iii. If the transit costs of imported tents are added to the cost of the tents themselves it is likely that, in many countries, the total cost will be substantially greater than that of rebuilding a normal, traditional house. This is particularly true of houses built out of local materials in the warm, humid tropics. But as a result of the divorce that often occurs between officials managing relief operations, and those concerned with longer-term reconstruction, such comparisons are rarely, if ever, made, and local cost-effectiveness is ignored;

Where there is a severe exposure to risk there is obviously a need for emergency shelter with a strictly life-saving function. But it should never be assumed that an able-bodied person will willingly die of exposure without taking personal action such a lighting a fire from debris. Here, in the mid-winter earthquake at Van, Turkey, in 1976, survivors have dug a hole in the ground and covered it with an improvised structure of plastic sheeting, thus obtaining warmth from the ground surface.

UNDRO

A 1976 flood in the Pansear Valley of Afghanistan washed most of this home away. Relief tents were placed within the building ruins, possibly to protect belongings (including animals) and preserve the ownership of the home.

iv. Inevitably, the climatic range of disaster-prone environments makes it highly unlikely that one (or even several) tent designs will be appropriate for all conditions;

v. They deteriorate very rapidly as a result of exposure to the weather. In addition, they are very vulnerable to wear and tear.

d. A further difficulty has arisen in numerous disasters: tents have been erected on emergency campsites, but have been under-occupied. This probably results from reticence toward camp life and the desire of families to remain close to their damaged or destroyed homes. In rural areas families are reluctant to leave their damaged property for fear of losing their crops and animals. A final reason (probably the major one) has been the fear of losing possession of land if it is vacated.

2. Imported designs and units

As already mentioned, there has been a general quest for a universally applicable emergency shelter to meet the shelter and housing needs of the developing world. Members of the design professions, voluntary agencies, industry and many university graduate programmes have been active in this type of research. Hundreds of designs have been offered; many have gone into limited production; a few have actually been used in disaster areas. Most of these shelters have been designed to take advantage – mostly in vain – of simplified construction processes and pre-fabrication, or to make use of new materials initially developed for use in industrialised countries. Examples of such units include the Bayer/Red Cross polyurethane igloos used after earthquakes in Gediz (Turkey), Chimbote (Peru), and Managua (Nicaragua), and the OXFAM polyurethane igloos used in Lice (Turkey). A survey of the success of these shelters has indicated that their use as emergency shelter or as temporary housing has been extremely limited, their performance and

It is important to understand survivors' priority concerns for shelter if assistance is to be effective. Tents may be useful, but it should be stressed that the emergency campsite run on military lines is never an attractive option, which is apparent from the evidence of the underuse of campsites from various disasters.

Following the 1970 Gediz earthquake in Turkey, the West German Red Cross in collaboration with the Bayer Chemical Company used their polyurethane disaster shelter igloos for the first time. They were used on three other occasions: Chimbote, Peru 1970, Nicaragua 1972 and the 1975 Lice earthquake in Turkey. They were finally abandoned as a system following the experiences in Lice in 1975.

El Coyotepe, Masaya, Nicaragua. Fifteen months after the igloos had been built, families had already made extensive additions/modifications. Note the rectangular profile of the additions, to suit local building traditions, in lieu of the alien circular form. Since the igloos could easily be cut, this proved very easy for such additions to be made.

acceptability poor, and their cost high. The reason (as has already been pointed out) is that their design criteria tend to be donor, rather than survivor orientated. The technology is often inappropriate, and assembly may require the skilled know-how of non-local personnel. Costs of transportation and the means of distribution are often ignored, adding substantially to the total costs of such units. While the donor may wish to have a standard unit that can be easily airlifted and rapidly installed, the recipient of aid will want a unit which is socially, culturally and climatically suitable, easy to maintain, and suitable also for other uses linked to this livelihood. In cases where there is a risk of climatic exposure, the provision of imported shelter often receives a fairly high priority. In these cases the emergency shelter is basically a humanitarian consideration. The long-term impact of the units is not considered, and questions of cost-effectiveness normally do not come into play.

The record of the performance of imported emergency shelters and the role they play during the emergency period suggest the following conclusions:

a. Emergency shelters made of local materials are both helpful and necessary in refugee camps resulting from war and civil strife, but their effectiveness after a natural disaster appears to be limited.

b. The majority of foreign assisting groups have concentrated on designing emergency shelter units which can be quickly flown in and erected in large volume. The problem, however, lies less in initial transportation, or in speed of erection, but in the distribution of the units within the disaster-affected area.

c. In practice, few donor-designed emergency shelters serve the purpose for which they were intended, i.e. life support or protection from the elements. The uses to which the survivors

Adjacent to the El Coyotepe campsite in Masaya, Nicaragua, following the 1972 earthquake the West German Red Cross donated 500 polyurethane igloos. Although such units only take two hours to fabricate, it took 148 days for the first igloo to be occupied due to logistical problems as well as difficulty in obtaining a site with approval to build. Approximately 30 per cent of the igloos were occupied despite the fact that there were no rent charges.

have put the units have normally been of a secondary type, i.e. storage, with the families themselves living in adjacent, improvised shelters, built at a fraction of the cost of the donor shelter.

d. In the poorer disaster-prone developing countries, donor shelters have consistently cost more (by any standard of comparison) than traditional structures.

e. The bulk of shelter provision following a disaster is provided and built by the survivors themselves. Even in cases where emergency shelters have been provided by external groups, most have arrived and been erected long after the emergency period).[33]

f. In the few cases where the shelters have arrived during the actual emergency, they have usually been set up as camps. As already discussed, the evidence indicates that the creation of such camps following natural disasters has a negative impact, creating long-term problems. Indeed, the introduction of emergency shelter units from the outside often forces relief officials to adopt hastily conceived plans for distribution and erection.

g. There are cases where imported emergency shelters proved to be of a lower priority than other relief items, especially medical and food items, thus leading to a waste of resources.

h. To summarize, there may be occasions when emergency shelter units are needed, but in such cases the evidence is overwhelmingly in support of their provision by the government, rather than by external assisting groups.

33. In Nicaragua the Bayer/Red Cross polyurethane igloos were not in use until 138 days after the earthquake of 1972.

3. Standard designs incorporating indigenous materials

In recent years there has been much interest in the development of designs for emergency shelters using indigenous materials. Most of the effort has centred on designs making better structural use of these materials.[34] While there is little doubt that the structural performance of traditional buildings can be greatly improved, many programmes of this type have been unacceptable to the local people and have therefore also been a disappointment to the agencies funding them. The reasons are as follows:

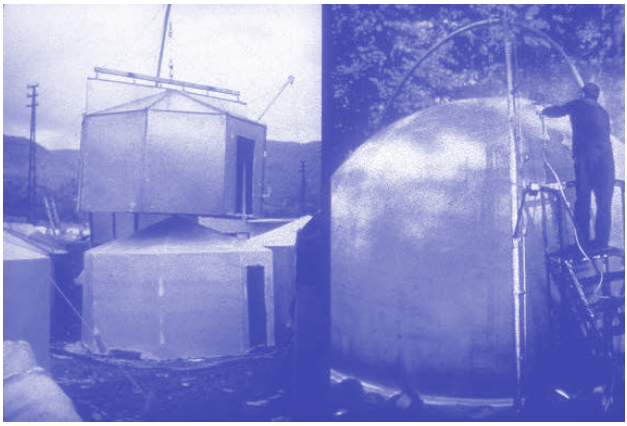
a. Structural improvements often increase the quantity of materials required, thus making the unit more costly (even though it may be less costly than one made of industrialized materials).

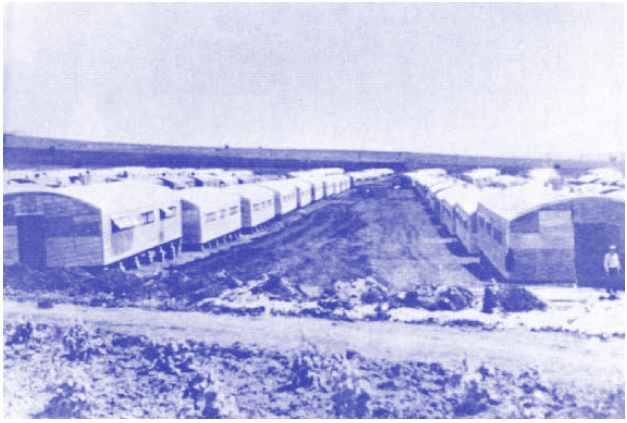
b. The modified units often result in architectural forms less functional than those traditionally used, representing the failure of designers to define problems from the survivor's point of view.

This is a typical scene in most of the Italian towns that suffered from the earthquake. Caravans came from all over Italy and Europe to serve as emergency accommodation. Most were on long-term loan pending the building of temporary housing.

34. In 1974, the Office of Foreign Disaster Assistance of the United States Government financed over 11,000 temporary houses in Managua Nicaragua, made from locally produced timber and corrugated iron sheeting.

In the early 1970s two agencies developed these disaster from polyurethane foam. However, after their initial use in four contexts both systems were abandoned. A great deal of money, time and energy was spent in the pursuit of a *universal* disaster shelter, but gradually their sponsors recognized that the effort was doomed to failure given local cultural and climatic variations, which resulted in diverse forms of shelter.





Skopje Resurgent, UN, 1970

Quonset huts provided in Skopje by the US Army. These houses are still occupied, nearly 20 years later, by the local population of gypsies.

c. Very few assisting groups employ qualified housing specialists who understand the building properties of indigenous materials in their local context (for example, if an agency decides to utilize bamboo, it must not only know how best to use the bamboo structurally, but the proper time to cut it; how to recognize whether it has been cured properly; how to treat it for different climatic conditions; and what materials to use with it, etc.).

d. There is the risk of environmental damage, by depleting supplies of indigenous materials. Unfortunately, little information on environmental impacts is available from developing countries.

Prefabricated housing built by the Turkish Government at Lice following the earthquake of September 1975. Many families objected to the form and siting of the housing. These objections related to their lack of participation in what was provided, and the cultural and climatic unsuitability of the housing.

4. **Temporary housing**

Temporary housing is usually provided by wealthy governments, and is extremely expensive in relation to its intended life-span. The units provided are expected to last for a period of several months to several years, prior to replacement with permanent housing. Temporary housing programmes are adopted when damage covers very large areas, and when the government feels that is short of capital and will take years to rebuild normal housing. The theory of temporary housing is that a low-cost, temporary unit can be provided at little or no cost to the disaster survivor who will be able to live in it long enough to obtain the capital necessary to rebuild a normal, permanent house. However, the main problem is that a *temporary* unit often costs more than a permanent structure (especially where the survivor normally builds his own home from indigenous materials). The evidence suggests that officials advocating temporary housing are frequently unaware of this. Where temporary houses are provided at a cost attractive to the survivor, they may receive a wider distribution than those sold at an unsubsidized price. However, a review of such cases shows that the houses become permanent, with all the ensuing problems of having created premature slums.

The following conclusions can be drawn from experience with imported temporary housing:

a. The distinction that is apparent in industrialized countries between *temporary* and *permanent* housing cannot be readily applied to developing countries, where a permanent house may be cheaper and built in less time than an imported *temporary* unit from an industrialized country.

b. The description *temporary housing* has frequently been used where shelter has been designed for a short life-span, but owing to its cost of replacement, it inevitably becomes permanent.

c. The term *temporary housing* has been used in some instances by officials to persuade people to accept housing that does not conform with their normal expectation.

d. In certain developing countries (e.g. in Latin America and the Indian subcontinent) families possess a form of *temporary shelter* in addition to their normal house – most frequently in rural areas where, during the harvest season, families move close to their crops – and which fulfils a very useful emergency role following disasters.

e. The policy of *two stage* reconstruction – pursued in the Italian earthquakes of 1976 and 1979 – where prefabricated temporary housing is subsequently replaced by the full reconstruction of damaged homes, is not viable in developing countries because of the extremely high cost of what amounts to reconstruction twice over.

This picture illustrates three types of disaster assistance following the Lice earthquake in Turkey in 1975. On the right, a pre-fabricated house as provided by the Turkish government; on the left an emergency shelter made of polyurethane provided by OXFAM; and in the centre, an improvised addition to the house made by occupants. Many families objected to the form and siting of the housing. These objections related to their lack of participation in what was provided, and the cultural and climatic unsuitability of the housing. OXFAM used their polyurethane house for the first and only time. Four hundred and sixty-three units were produced.

5. The distribution of materials

Many assisting groups feel that the key to shelter provision is to provide adequate or improved building materials (or machines to produce these materials), thereby omitting the design process altogether. In some instances, this approach is intended only to replace housing destroyed by the disaster; in others, minor improvements, such as the introduction of lightweight roofing materials, have been attempted in the hope that these will reduce vulnerability. Assisting groups have not only provided building materials, but have also undertaken extensive housing education programmes, concentrating on the improvement of local building construction skills in order to strengthen housing against natural hazards. Use of this educational approach is encouraging, though its impact is not yet clear. There are three main problems with the materials' distribution approach:

a. If the material is not local, the demand it creates may not be met in the long-term for maintenance and repair;

b. The introduction of such materials may necessitate the modification of basic designs, creating unforeseen problems;

c. Perhaps most importantly, this approach requires the introduction of effective price controls.

d. There are various measures which can be employed by national governments and assisting groups to assure a steady supply of materials at fair prices after a disaster.

These include:

a. **Stockpiling**
This topic is discussed in section 4.7. It is a mechanism with many limitations, but a stockpile programme may be necessary to guarantee a material's supply, and mitigate the effects of commercial speculation.

b. **Price subsidies**
If the scale of the subsidy programme is great, it virtually ensures that retail suppliers at the disaster site cannot ask higher than competitive prices.

c. **Congregate purchasing**
Another measure might be called *congregate purchasing*, necessary to control prices of the manufacturer or wholesaler. Assisting groups could pool their resources and seek competitive bidding from suppliers or manufacturers of materials. It is most likely that they would get more favourable prices than if they were in competition with each other for the same materials.

d. **Price controls**
Price controls placed on materials by national governments have had mixed success. The policy is not completely effective if the controls do not extend throughout the distribution network. This type of policy has had some success in Peru, where the government not only fixed the price of cement, but also purchased it and resold it directly to the consumer at the fixed price. It should be stressed, however, that controlling costs in post-disaster situations encompasses more than just the cost of building materials. Cost control policies should also take into account the costs of land, building repairs, the installation of new infrastructure, and building labour.

6. Core housing

A simple, low-cost frame or solid core is provided and can be used as an emergency shelter or temporary structure. The core is designed to be permanent and more hazard-resistant. Over a period of years the occupants are expected to fill in the walls with whatever materials are available. This approach has had varying degrees of success, depending on the relative cost of the core, security of land tenure, the extent to which accompanying education programmes were carried out, and other socio-economic factors.

7. Hazard resistant housing

Since the rebuilding by owners of damaged or destroyed houses usually starts very soon after a disaster, there is always an urgent need for technical advice on safer siting, structural improvement, and basic architectural improvements, in order to improve overall resistance to hazard. However, it has been found that there are considerable difficulties in making advice available to house builders.

These include:

a. Providing such advice in time;

b. Finding an appropriate format for the advice, given that many builders may be illiterate and unable to read working drawings;

c. Providing technical advice relevant to the skills of local builders on structural improvements, using the available building materials;

d. Making proposals that are economical and culturally acceptable.

8. Accelerating the reconstruction of permanent housing

Following the 1976 earthquake in Guatemala, a number of assisting groups developed a different strategy: instead of attempting to provide emergency shelter or temporary housing, they concentrated on encouraging rapid reconstruction of normal housing. This approach assumed that people would look after their own emergency shelter or temporary housing needs, enabling assisting groups to put the emphasis on rapid reconstruction. In this approach, houses could be rebuilt to the standard represented by those which did not fail. Reconstruction to an improved standard would occur where the majority of houses failed as a result of inherent weaknesses of design, building methods and use of materials. Rapid reconstruction requires that the survivors have the means to accede, in one manner or another, to permanent housing. As most building will be carried out with self-help methods, reconstruction to an improved standard necessitates the introduction of more advanced building techniques, but at a technological level which can be assimilated by the community, and at a price it can afford. The advantages of using this approach are as follows:

a. It enables limited resources to be concentrated where they will have a permanent effect, and thereby be cost effective;

b. It reduces the time during which people are without permanent accommodation;

c. The use of self-help methods keeps housing at a price the local people can afford, and allows decision-making to be kept at a *grass roots* level;

d. It uses and builds upon the existing housing process and the skills which exist in the community.

In the Van earthquake in Turkey in 1976, there was evidence of families beginning to rebuild their own homes at once, and in many cases the improvised shelters form the core of a new house. Here, the provision of tools and building materials (or the money to buy them), together with training for safe rebuilding, is clearly the most effective form of relief.

There are few, if any, major disadvantages in opting for rapid reconstruction, but it does require the support of the government, and a long-term commitment on the part of the assisting groups. Assistance can come in the form of price controls, low interest loans, technical assistance, training, self-help and employment schemes linked to housing, etc. It may also require the local government to address some sensitive problems such as land reforms, security of land tenure and alteration of land-use patterns. Such a policy pre-supposes that, for certain hazards, reconstruction will take place in different locations.

Of all the shelter strategies available after a natural disaster of sudden onset, rapid reconstruction appears to be the best: it accelerates full recovery and makes optimal use of local resources, human and material. In the past, some agencies have undertaken a 1-2-3 strategy, i.e. they provide emergency shelter, temporary housing, and then permanent housing. Some agencies have taken the shorter but still costly routes of 1-3 or 2-3. These routes can be wasteful unless the materials and skills contributed in the first instance contribute significantly to the final 3 stage of reconstruction.

The emergency shelter needs of survivors may be regarded as a function of the time taken to build a house under normal circumstances.

Policy guidelines

Policies to avoid

1. Determining shelter needs for survivors based on the roles and perceptions of assisting groups alone.

2. Designing, manufacturing and stockpiling prefabricated emergency shelter units (other than tents), as this solution is too costly and a waste of resources for developing countries.

3. Assuming that there will be a direct correlation between numbers of houses damaged or destroyed, and numbers of families needing emergency shelter.

4. In the case of earthquake disasters, neglecting the emergency shelter needs of families who fear to occupy undamaged houses, in case of aftershocks and subsequent damage.

5. Considering shelter as a product rather than as a process.

6. Erecting large, camp-like concentrations of tents or temporary housing.

7. Building temporary housing as a form of emergency shelter.[35] Since temporary housing is rarely, if ever, replaced by permanent housing, assisting groups should, whenever possible, by-pass

Subject to safety checks, undamaged public buildings may provide temporary accommodation such as this convent in Bolivia used to house flood victims. These buildings should be identified in advance of a disaster. They may play a significant role, but this will always be limited to the need to return them to their original function as soon as possible.

35. There may be certain exceptions to this, principle where rapid reconstruction cannot occur, i.e. in extreme winter conditions, or in the industrialized countries. The evidence from Skopje (Yugoslavia) 1963, Friuli (Italy) 1976, and El Asnam (Algeria) 1979, indicates that there was a massive demand from both the public and the authorities for temporary housing. Reasons for this included: high expectations of governmental aid; climatic risk; an active private building sector; expectations of very slow reconstruction.

Another response of many families displaced by sudden onset disasters is to move in with relatives or friends living in unaffected areas. In some cases officials may improvise this form of assistance by requisitioning schools or churches, etc. however, with the likelihood of overcrowding, and the need for public buildings to return to their normal use, such measures are strictly short-term.

this option, and move directly towards assistance in providing permanent reconstruction.

8. Spending all resources for shelter in the emergency period while aid is plentiful, rather than earmarking a proportion of these resources for rehabilitation and reconstruction, when the need for cash, materials and expertise is likely to be extensive in scale and prolonged in duration.

Policies to adopt

1. A study of the normal (pre-disaster) housing process.

2. Follow the advice already given in section 4.3 (The assessment of survivors' needs), in order to achieve accuracy in forecasts of shelter needs.

3. Provide appropriately designed tents, but only if they are found to be absolutely necessary (caution is needed to avoid any conditioned reflex that disaster recovery equals the need for tents).

4. Provide building materials and tools for emergency shelter and reconstruction programmes. Plastic sheeting and blankets have been found to be very effective relief items in all types of natural disaster.[36]

5. Accelerate the housing reconstruction process to hazard resistant standards, consistent with the resources and capabilities of the community.

6. Include land and infrastructure as integral components of housing reconstruction.

7. The evaluation and continual monitoring of shelter provision is a vital requirement for the development of more effective policies by assisting groups. It is proposed that a proportion of all disaster assistance, perhaps ten per cent be designated for this purpose.

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36. OXFAM, (a British voluntary agency) has found that in nearly 40 years' experience of disaster assistance, the most common request relative to shelter has been for blankets.

Summary of significant developments over the past 30 years

— In 2005, the Inter-Agency Standing Committee established the Global Shelter Cluster. In natural disasters, the cluster is convened by IFRC and in conflicts by UNHCR.

— Impact of mobile phones; diaspora remittances increased and money transfers in promoting rapid shelter repairs and rebuilding are far more widely used:

This capacity is based on certain assumptions:
- *there are local suppliers of the appropriate supplies, such as shelter and building materials, but their capacity may not be as effective in a truly catastrophic event.*
- *mobile communication and data transfer infrastructure are both robust and resilient.*
- *the emergency response system focuses on rapid checking of and restoration of mobile towers and local decentralized) power systems.*[37]

— Development of shelter standards as part of the Sphere Project (2004 and 2011).[38]

— **The Use of Tents**
Tents continue to be regarded as an unsatisfactory solution and should not be considered in isolation. They should be complemented by non-food items appropriate infrastructure, services and support.

— **Plastic sheeting**
Since 1982, *plastic sheeting* has emerged as an emergency shelter strategy. As noted in the IFRC and Oxfam publication of the same name,[39] plastic sheeting is a sheet of strong, flexible, water resistant or waterproof material. Plastic sheeting should be distributed only when more durable or superior materials are not locally available. Plastic sheeting usually has advantages over tents in that the sheeting can be used in a multitude of ways, including as part of a repair kit of damaged housing.

— **Pre-fabricated imported shelters**
The problems associated with pre-fabricated imported shelters cited in the text still hold, but there is increased awareness of the lost opportunity, caused by importing shelters, for the local economy.

— **Transitional Shelter**
Transitional shelter has evolved as a controversial shelter strategy. One school of thought and practice proposes a three stage approach

37. Franklin Macdonald, ex-National Director of Disaster Management Agency in Jamaica

38. Sphere Project. ***The Sphere Project Humanitarian Charter and Minimum Standards in Human Response***, Chapter 4 Minimum Standards in Shelter, Settlement and Non-Food Items, Geneva: pp. 240–267, 2011. Available at: http://www.sphereproject.org/

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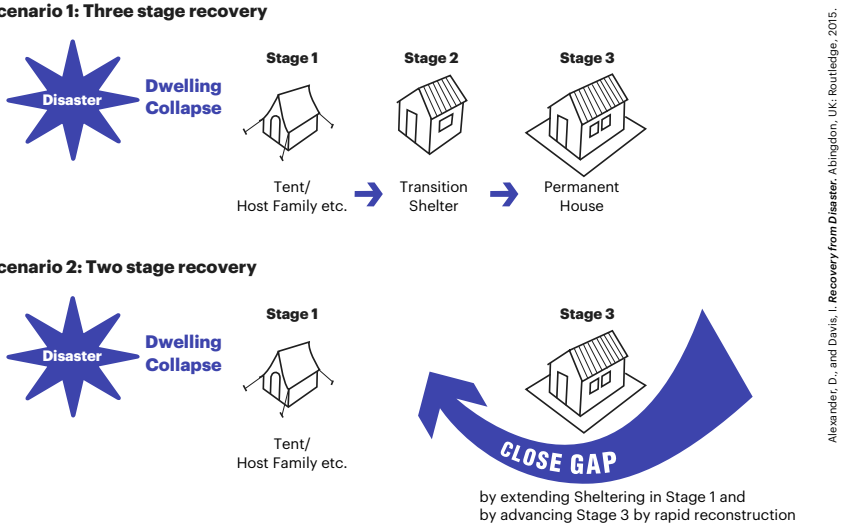
to shelter and housing, as a *default position,*[40] while the opposing view[41] challenges the need for *transitional shelter,* (except for certain extreme conditions, such as severe climates, urban needs in industrialized countries, delays in reconstruction because of revisions on codes and tenure issues). The implementation of transitional shelter is more complex – it is a process rather than a product. The transitional shelter concept supplements the Sphere Project minimum standards, which are designed to meet individual and families' emergency shelter needs. In Diagram 2 the following two alternative options are described:

— **The three stage approach**, including *transition shelter* is indicated below as Scenario 1.

— **The two stage approach**, excluding *transition shelter* is indicated below as Scenario 2. This option can only be made possible by extending the life of immediate sheltering and promoting rapid reconstruction.

Diagram 2
Scenarios for the shelter and housing continuum



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41. Davis, I. 'What have we learned from 40 years' experience of Disaster Shelter?' ***Environmental Hazards*** 10, pp. 193–212, 2011.

New shelter strategies have emerged since 1982

— **Host families**
In many disasters, survivors are able to find refuge with host families, typically from members of their extended family or neighbours. Nevertheless, host families as a solution is not long lasting because of the cost and stress put on both host and survivor families.

— **Rental housing**
A variation of host family for survivors is rental housing, i.e. paying the owner for the use of the accommodation that is available. Assisting agencies may be able to support this option as well but it is more complicated if property owners appear to profit unfairly from this arrangement.

Shelter following conflict

— The *1982 Guidelines* focused on shelter after natural disasters, with little attention given to conflict and yet more frequently natural disasters are occurring in protracted conflict areas. Therefore it is important to be mindful of the distinctions between the two, for instance the capacity and/or appropriateness of the national and local government to take the lead in allocating roles for shelter and housing assistance. Furthermore, agencies need to determine if the government subscribes to their responsibility to provide assistance without bias. Additionally, agencies may have an extra challenge to strengthen the capacity of government when it has been weakened by the consequences of the conflict.

— There are fundamental differences between shelter after disaster and shelter after conflict. In the short run, the challenge of reconstruction after conflict is primarily to avoid conflict and to contribute to stability and national reconciliation. Shelter and housing reconstruction programmes in post-conflict stands a higher chance of success when integrated with other peace building strategies. The following matrix[42] compares and contrasts these two scenarios:

42. Paul Thompson developed this comparative table, reviewing the following paper: Barakat, S., ***Housing reconstruction after conflict and disaster,*** London: Humanitarian Policy Network, Network Paper No. 43, 2003. Available at: http://www.odihpn.org/documents/networkpaper043.pdf. However, Baraket makes few, if any, references to the differences between post-disaster and post-conflict housing in this paper.

After natural disasters	After conflict
Survivors are usually able to return to their home community in a matter of days	Survivors may have been displaced for a long period, even decades
Disasters often strengthen social bonds and commitment to community, energizing collective determination to rebuild	Housing may have been destroyed as part of a strategy of ethnic cleansing; reconciliation may be a prerequisite for reconstruction
Land tenure problems are less frequent or contested	Legal records may be lost, land tenure or prior ownership may be difficult to determine or negotiate, houses may have been destroyed or confiscated
Many disasters result in an outpouring of international support	The risk of a return to hostilities may suppress international support, investment and reconstruction activities
The basic *enabling environment* of government, financing mechanisms, physical infrastructure, building material supply, construction labour and social networks may still be in place or return to operations relatively quickly	The *enabling environment* may be non-existent or destroyed and require considerable time to rebuild, especially local authority, security and legal frameworks
Sites of destroyed houses may be unsafe because of geological or hydrological reasons	Reconstruction zones may be mined
Appropriate reconstruction usually requires improvements to the site and/or construction technology	No changes in site or construction technology may be required
Shelter and housing reconstruction programmes should be designed to maximize the economic potential to jump start recovery	The employment of young men and ex-combatants, especially in the construction sector, is one of the highest priority strategies for peacebuilding and must be linked with the other priority strategies of providing basic services and support to clean government

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Fig. 01: Interior view

“ARCHIAID PENINSULA SUPPORTING SEMINAR – CORE HOUSE WORKING GROUP”
Ishinomaki (Miyagi), 2012

The Core House was designed for the city of Ishinomaki on the Oshika Peninsula, which was severely affected by the destruction caused by the tsunami in the aftermath of the earthquake of 2011.

It is a low-cost and expandable model house intended to enhance the reconstruction efforts in the region. The idea of “Core House” is an adaptation from the one originally introduced by the Indonesian architect Ikaputra who conceived a model using a small and simple replicable construction easily adaptable by community, in the context of the reconstruction after the Java Earthquake in 2006. Such concept has been translated for the Tohoku region into a design that employs a local type of Japanese timber construction called “Itakura” which uses pre-assembled timber boards inserted between the columns, allowing for a fast construction process. The system has also been updated to meet contemporary standards for fire and earthquake resistance. As fishery is one of the main activity in area, the design of the Core House takes into particular consideration the lifestyle of fishermen, such as for example by including a covered outdoor space for work activities.

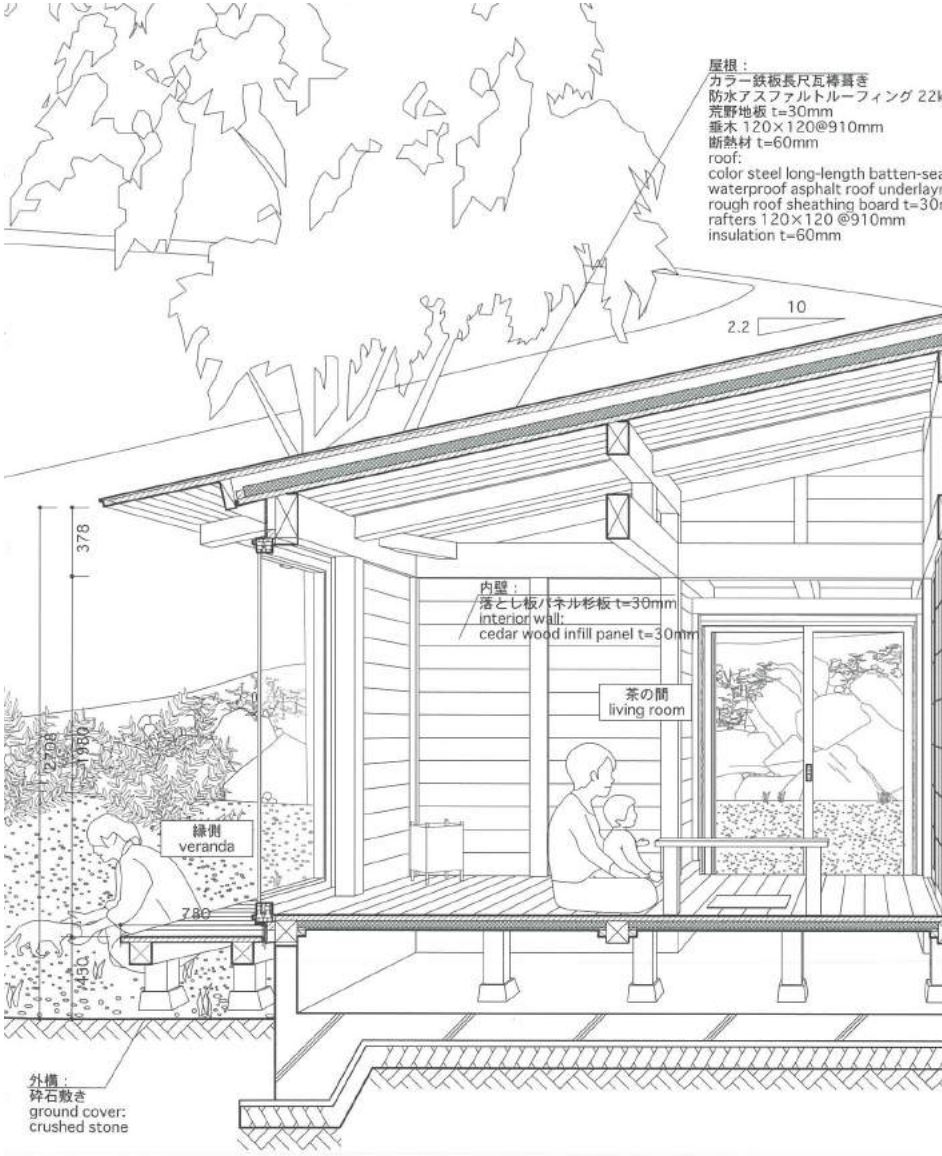
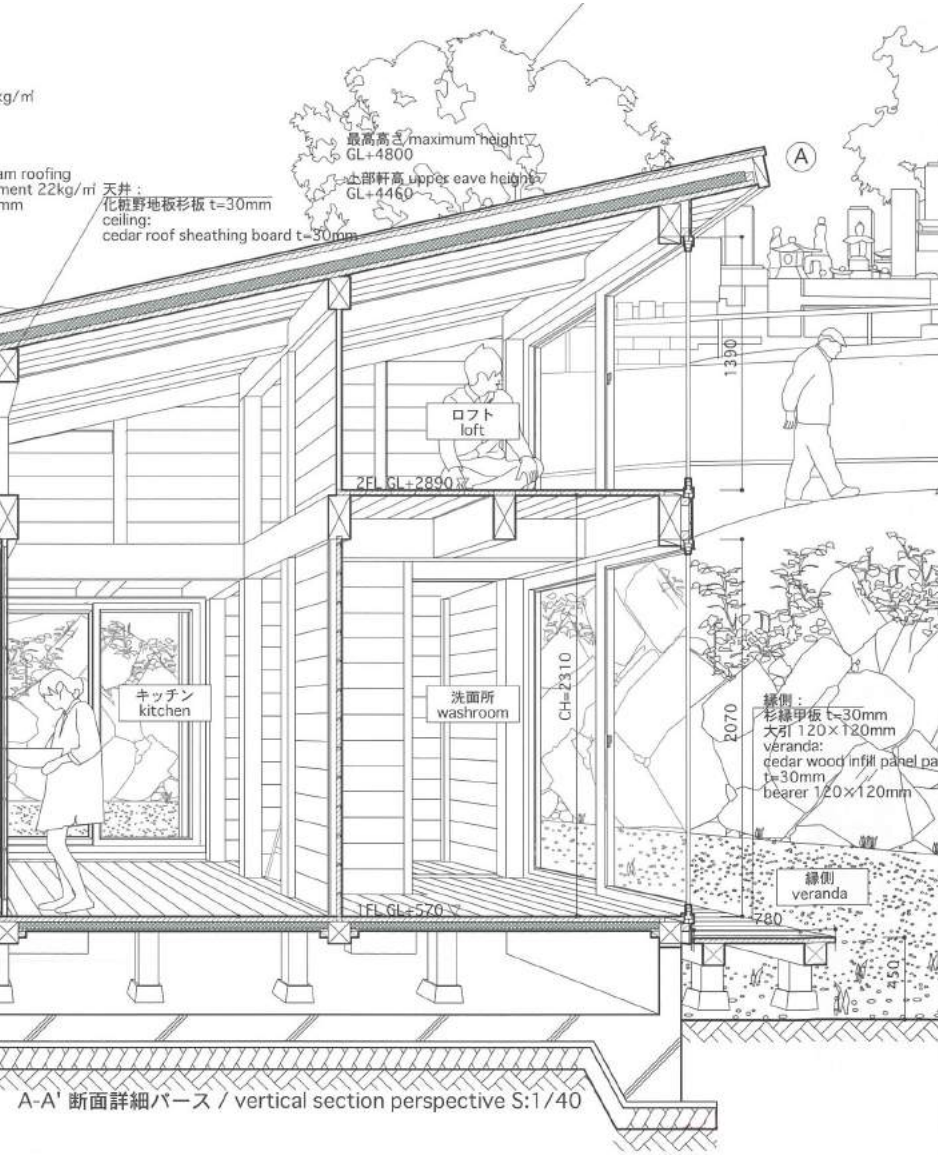


Fig. 02: Section perspective (scale 1:30)



A-A' 断面詳細パース / vertical section perspective S:1/40

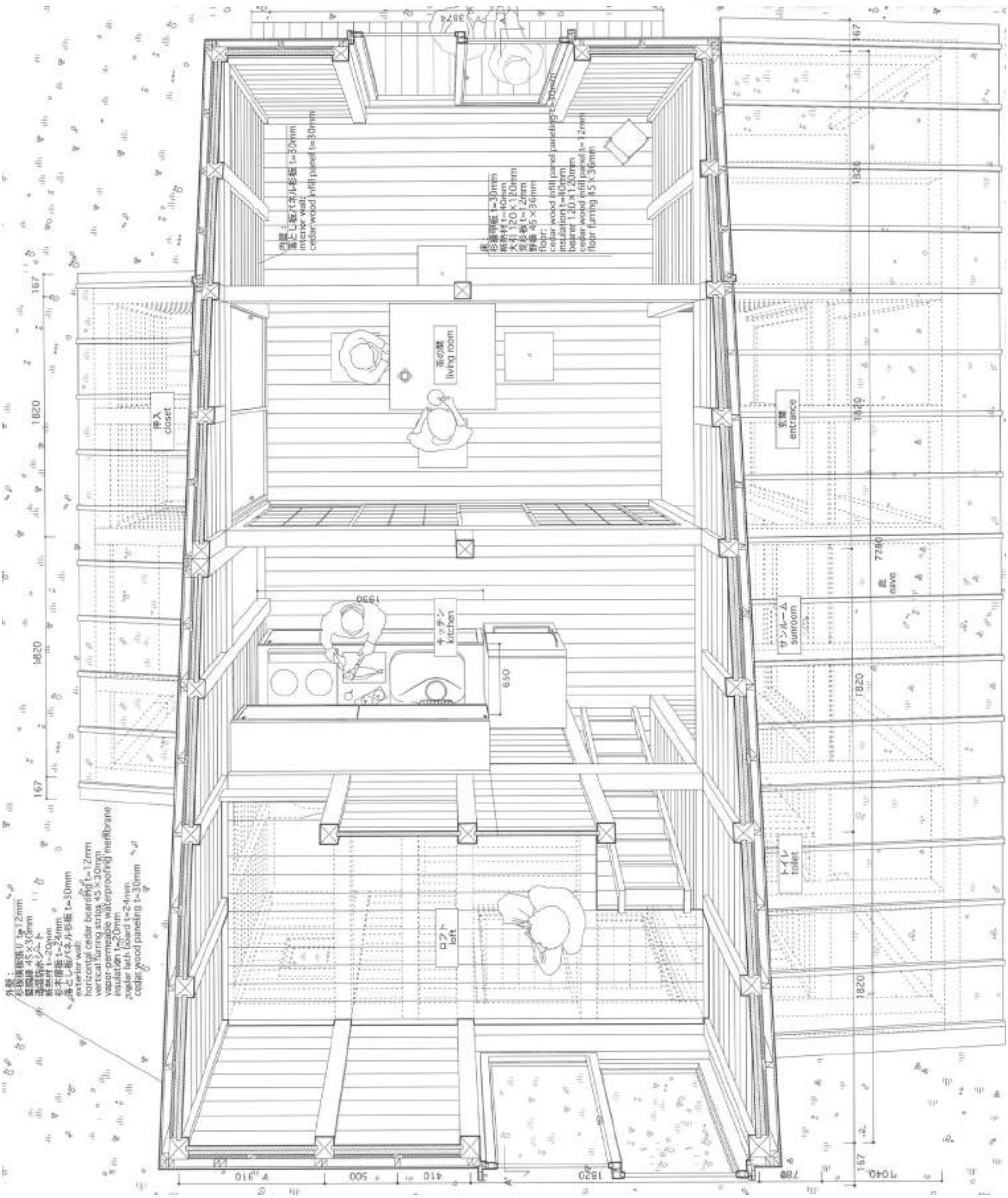


Fig. 03: Plan perspective (scale 1:50)

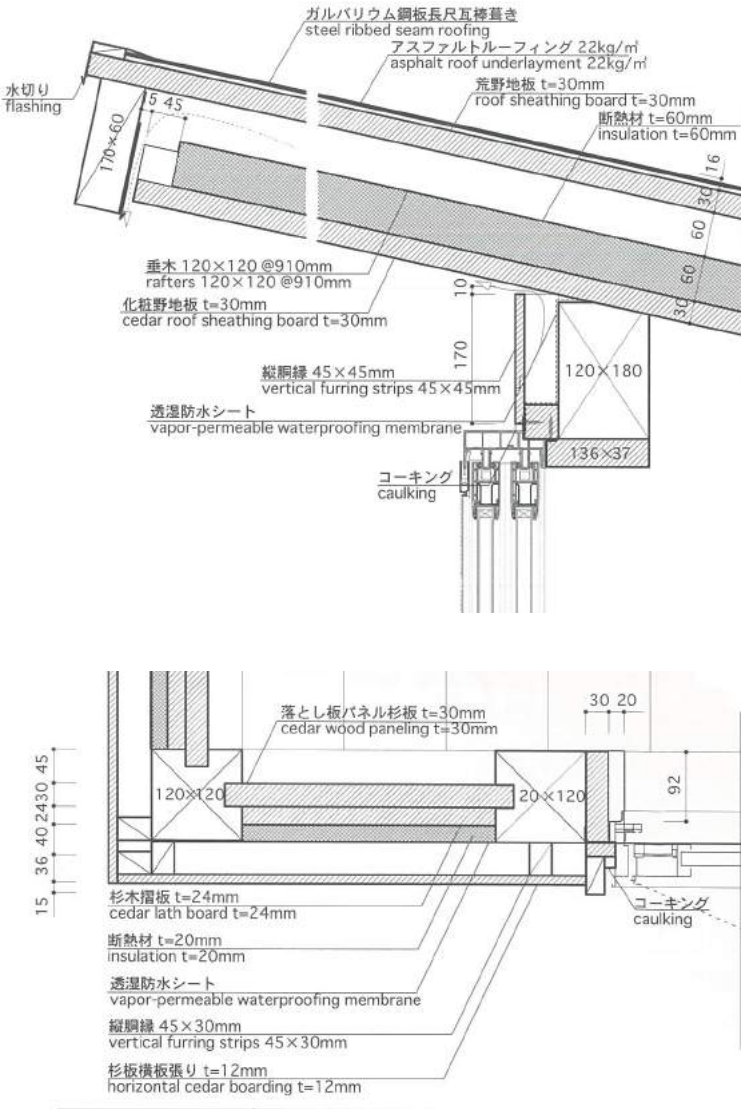
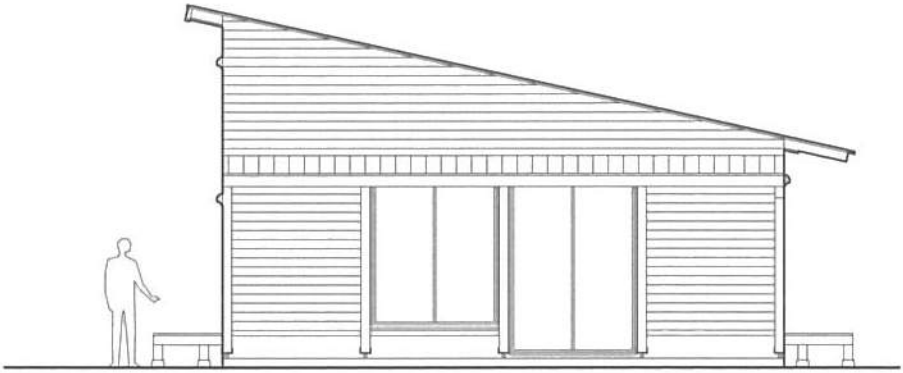
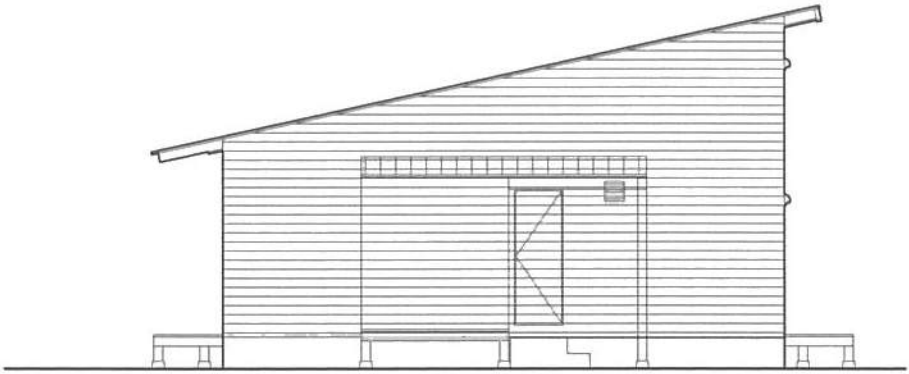


Fig. 04: Details (scale 1:10)



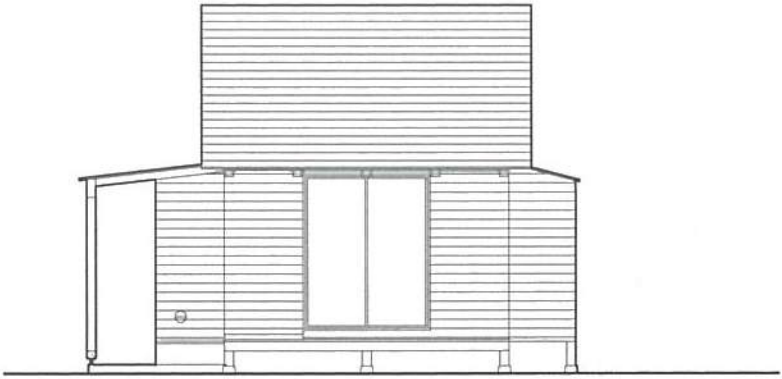
南立面図／SOUTH ELEVATION



北立面図／NORTH ELEVATION

Fig. 05: Elevations (scale 1:100)

西立面図／WEST ELEVATION



東立面図／EAST ELEVATION

CORE HOUSE: A STRUCTURAL EXPANDABILITY FOR LIVING
Study Case of Yogyakarta Post Earthquake 2006

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ABSTRACT

The house reconstruction after Java Earthquake 2006, is an example of how more than 180,000 units house were constructed within less than a year. Disaster event—such earthquake—is not only ruining "a house" but also "a life" of many families. They lost their house, belonging, and even beloved family. They suffered shortage of supports to revive their owned family life. In the same time, support from others, donors, and government were definitely limited. A strategy to cope with the issue should be addressed to speed up a house reconstruction for family life revitalization within a lack of resources. A core house is one of concepts or models using a small and simple replicable construction which easily adaptable by community. This small earthquake resistance house is designed to have economic construction cost so that this approach could maximize the number of family impacted. The core house is expected to be expanded by families through process of construction support sharing or a subsidized approach among government, donors, and family owned sources.

Keywords: core house, java earthquake 2006, structural extension, post disaster reconstruction.

CORE HOUSE: THEORETICAL FRAME WORK

The word "*core"* is similar to the ones of "*substance"* or *"essence"* which mean the choicest or most essential or most vital part of some idea or experience.[1] *Core house* can be understood as the most essential or most vital part of house for family living. The philosophy of the *core house* is most likely fit to the concept of Modernism: efficiency. How make a house that is efficient for the family need? The concept behind core house is not to minimize space but to maximize the use of the space for the family life by accommodating their needs in a house.[2] In the time of post disaster, the core house concept can be functioned as a transitional emergency relief housing but permanent construction. Bryan (2008) explained that the core house would serve as a vital building and catalyst for community revitalization. But the concept also keeps on the approach to maximize the number of households impacted when the transitional housing program is designed to fulfill the minimum requirement for family life after disaster. In other words, the core house approach is aimed to maximize the number of the beneficiaries.

The principle of the core house should be flexible and expandable. The core house would function as a starting point for family growing and accommodate the immediate needs and the possible future development. The possible growing core house is defined as a small unit or permanent structure that can be extended into a larger house. The core house system can be based on structural, architectural, and economic ideas.

The *structural system* of the core house can be developed from two main construction methods. First is a system of a core house within a compact module that can be prefabricated in a controlled environment and easily transported to a building site. (Bryan, 2008) It is a sort of prefabricated module's structure. Second is a method to extend the core house by simply repeating the framing structures. (Golembiewski and Wong, 2005) The great strength of the later system is that future extensions or adaptations of these homes can follow the existing structural axis. The structural system developed for the core house, especially for disaster relief housing, should consider material's usages and construction techniques which allow local community to do extension later on. The modular structural system or the possibility to repeat the structural frames is the key to sustain the extension. Thus, core house is built by the construction of the basic structure with the intention to be completed at a later stage.

The *architectural system* of the core house should promote the issue of extend-ability which makes the core house be readily expanded in many ways as required by by beneficiaries. (Potangaroa, 2005) The system should accommodate the process of building, of first functioning as family living place, and then of keeping on additional room(s) to the core to complete the house suitable for the family need later on. The system allows survivors move back to their

[1] See in the web dictionary on wordnet.princeton.edu/perl/webwn
[2] See also a web of the core house design consultant defined and promoted a core house at http://www.coremodern.com/

communities or back to the family life immediately with minimum standard and expand the house according to their own life need over time. The core house usually accommodates the possibility to customize the house to meet the inhabitant's specific spatial needs. (Bryan, 2008) The ability to customize the core house shows the adaptability of any prototype and standardized design to be altered in various ways adopting a locality of individual family. The architectural extend-ability in the core house becomes an important component for social and cultural living sustainability required by house design post disaster.

The *economic system* of the core house in the post disaster relief program relies on subsidized support program. The subsidized shelter delivery program deals with the poorest situation of the survivors. They have lost everything including family members and livestock, the program would work through a subsidized approach. (Luethi, 2001) The core house relief program can be developed through cash grant which is according to Aysan et.al. (2006) is expected to be sufficient for constructing a core house, and then, to be expanded out of the savings of beneficiaries or the 'top-ups' of agencies. It is different with the relocation program the core house for transitional housing program usually utilizes existing single lot of the beneficiary. The land problem for housing after disaster is usually solved first before the core house constructed. In this case, the affordability of the housing relief program then refers mainly to the requirement of the house program that relate to the cost of housing both at initial occupancy—the core house—and to the cost over established time frame: the expanded house.

CORE HOUSE: YOGYAKARTA POST DISASTER RECONSTRUCTION

The First question came up when we related the core house to Yogyakarta Post Disaster Reconstruction is "*Why the core house was needed?* In a UNDP's Draft (2006) titled "*Suggested Strategic Framework for Sub cluster on Transitional Shelter Early Recovery Cluster*" mentioned an assumption that:

> *More than 300,000 families were made homeless by the earthquake which struck Yogyakarta and Central Java on 27 May 2006. Emergency shelter support (tents and tarps) are being distributed one per family. It is expected that support for permanent housing reconstruction may be delayed. Permanent housing reconstruction may take up to two years. It is essential that*

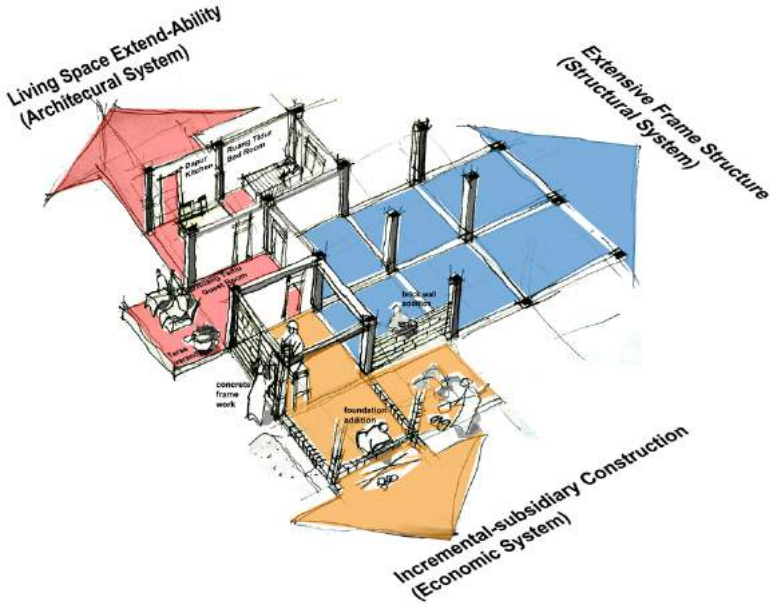

Figure 1. The Core House Design Principle

people have improved shelter to enable them to survive until their homes can be rebuilt. Many people have already begun to build their own improved shelter. However, many others do not have the materials, tools or skills to build their own shelter without assistance.

The situation of possible delayed support for permanent housing reconstruction and the need of shelter improvement for family survival while the waiting for home reconstruction made the need of Transitional Shelter in a high demand. Transitional Shelter which is also called as *rumah cikal* was aimed to bridge the gap between emergency shelter and durable-permanent housing. It was proposed by Shelter Sector Forum for Yogyakarta and Central Java Post Earthquake 2006, three types of *rumah cikal* or T-Shelter. Those are called Type A. *Seed house*, Type B. *Starter Structure*, and Type C. *Combined Shelter Workplace*. The *Seed House* or temporary structure made of materials (timber, bamboo) intended for disassembly and reuse, or to be used as part of permanent housing. The *Starter Structure* is an earthquake resistance structure that becomes part of permanent house (i.e. foundation and frame, or single room, etc.). Mean while the *Combined Shelter Workplace* has been aimed for households with home business since many home based industries suffered from the earthquake. In this case, the core house is most likely similar to the *Starter Structure T-Shelter*. (See Fig. 2) The government program on house reconstruction was planned to develop minimum 36 sq meters permanent house. It is a standardized house size for young family planning with two children. The Scheme of the core house type and house reconstruction time frame can be shown as follows.

FOCUS OF THE RESEARCH AND THE CASE STUDY

This research is based on one of core house types implemented in Yogyakarta Reconstruction Post Earthquake. The focus of the study is more on observing the structural extension of the core house which is done by community. The other two aspects of core house—the architectural system extension and economic aspect of financial support to extend the house—are not as main discussion. However, in the discussion the other two aspects can be related to the tendency of structural extension by the family who lives in.

The observation of the implementation of the core house was held in two villages as case studies: Kasongan and Kebon Agung. Kasongan was located *kecamatan* Kasihan a sub-district relatively far from the fault and categorized into the ring four level of vulnerability which has the Ratio of the victims and house damage between 1:30 to 1:50. (Ikaputra, 2007) Meanwhile Kebun Agung was located in *kecamatan* Imogiri, located near the fault system but it is categorized into the ring two level of vulnerability (the ratio between 1:17 to 1:23). Understanding the nature of the village location, the closer the village located to the fault, the higher vulnerability the village suffered, and logically the more attractive donors came and made a priority to support it. Although the Kasongan village was relatively far from the fault, it was a famous ceramic craft village which needed to be rehabilitated soon due to its role for district economic revival. Therefore both of Kasongan and Kebon Agung were matched to the purpose of and considered by donors.

In the other hand, the case of the core house construction in Kebon Agung had a different situation. It was implemented in February 2007 when the government's reconstruction program had been launched for 5 months. It was the time that almost all totally damaged house had been covered by the government's program and some were still undergoing construction in that time. This situation made more difficult to any donors to find the most vulnerable families to be supported to rebuild their house. What it was remained as challenge for donors to help survivors was *a gap* between the government requirement for house reconstruction and the reality in the field. The government policy for house reconstruction was "one damaged house one package

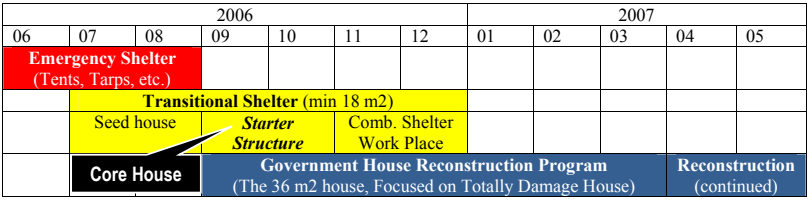

Figure 2. The Core House within the Shelter & House Reconstruction

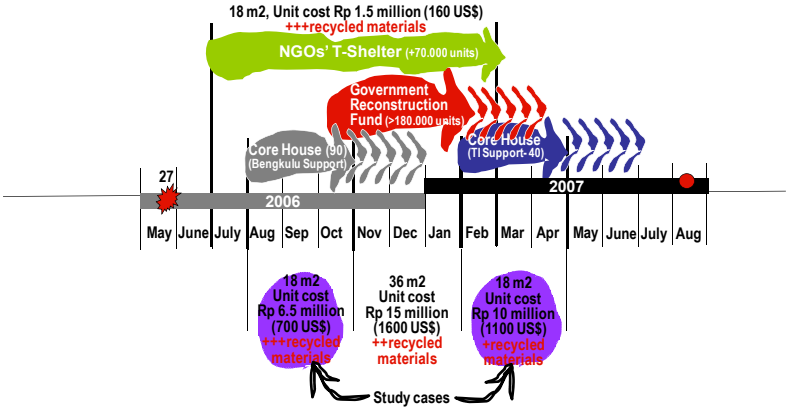

Figure 3. Different Time & Context of Implementation

support" neglected that in one house was lived by more than one family or generation. Many Javanese families live with an extended family—a common basic social unit. The selection of beneficiaries came into relatively vulnerable village but also had in one damage house lived by extended family.

THE CORE HOUSE DESIGN AND ITS GUIDE LINE

A Core House Design was developed in earlier of July 2006, about a month after earthquake. The design was resulted from the discussion among community figures, university's student who did *Kuliah Kerja Nyata* (Student's Community Service Work), and Gadjah Mada University. The core house design basically has 18 m2 plan size, a minimum standard for living units fit SPHERE (2004). The structure was proposed by KKN's student from Civil Engineering faculty. It consists of two modules of 3 x 3 m2. The two modules of that size became the basic repeated frame for structural extension. The module was also favorable by the community because the size was flexible enough to accommodate their living activities. A simple traditional roof so called *pelana* which its gable at the front façade was suggested by Gadjah Mada University. The extend-ability of the core house was directed to the back part of the core house (See Fig. 4.) .

Although the core house principle should ideally accommodate issues on structural and architectural extend-ability as well as incremental construction based on family economic situation, the critical issue was still focused on structural one. As many people observed and learned from Java earthquake 2006, in most cases, the house structures were brick masonry with weak reinforced concrete (RC) (Ohno & Rachma, 2006), even many of the half brick masonry houses were built without any reinforcement (Boen, 2006) Based on those structural issues, the core house design was supported by construction process illustrated the important of reinforced concrete framing known as "practical columns and beams". (See Fig. 5).

In addition to the 9 steps of core house construction, "On Spot training" had been done to ensure that the construction accomplished the structural requirement. Furthermore, a voluntary supervision done by educational staffs and students of Civil Engineering and Architectural Departments was set periodically to construction sites. This mechanism became customized by almost all universities of which their engineering faculty involved in the post disaster reconstruction support.

THE DISCUSSION ON IMPLEMENTED CORE HOUSE EXTENSION

The Tendency to Extent the Core House

From the field observation, it was found that in Kasongan case almost all core houses had been extended (97.22%) within one year development. It was only left one house not extended because was

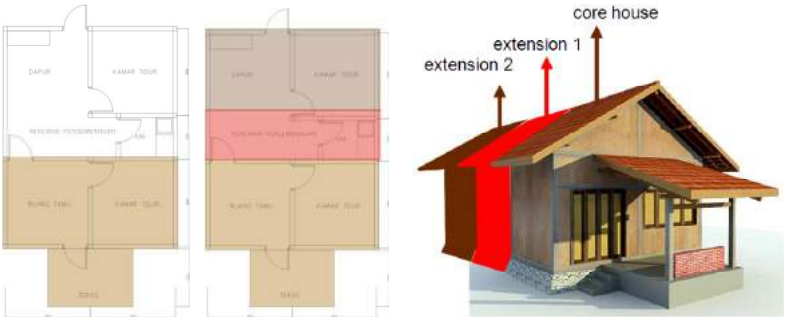

Figure 4. The Plan and Its extension of Core House

Figure 5. The Process of the Core House Construction

lived by an aging person. Meanwhile Kebon Agung case, the extended core houses have been reached 30 % for six month after the core constructed. (See Fig. 6) The different time frame of implementation would be one of reason why the two cases have different tendency to extent the house. One year span of time in Kasongan gave the possibility to the family to find a financial source and donation to develop their house. It would be fair if the comparison between Kasongan and Kebon Agung were taken with the same span of time. However, if we looked at to the size of the lot where the core house was constructed in Kebon Agung, it can be predicted that it was still left around 35 % of core houses had possibility to be extended. But it was not for 32.5 % of them due to the lack of land size for expansion. This prediction shows that although both cases would be compared with the same span of time, both could not have similar achievement. In other words, core houses' extension percentage of the Kebon Agung had never reached as high as ones of Kasongan due to the land or lot size. The position of the core house implemented at Kebon Agung as "a part" of earlier developed house can also be the argument why the structure was not extensive enough. As we know the core house implemented in Kasongan became the "core" of the later stage of development. The key element of successful core house extension, beside of the time span that allow for extension, it is also influenced by the land lot size and the position of the core house within the development scheme of family (or extended family) plan.

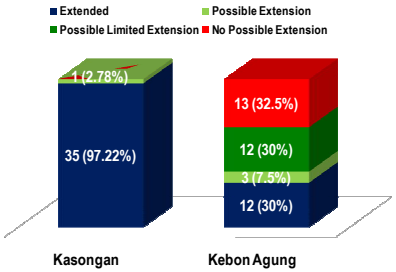

Figure 6. The Tendency to Extent the Core House

The Modular Expansion of the Structural Frame

The core house utilizes a modular design which offers the advantage for the possibility of future expansion. The modular design is a standardized unit or dimension allows flexibility and variety in use. Modular design is an attempt to combine the advantages of standardization (within reduction in cost, less learning time, lesser customization) in the first construction stage with those of customization at the later stage.[3] The modular design of the core house for Kasongan and Kebon Agung has its standardized unit based on a small structural unit for non-engineering building estimated for earthquake resistance. The modular unit was developed from a structural reinforced concrete frame consists of "practical columns and beams" formed approximately a double 3 x 3 m2 size plan. This structural frame size also is functioned as the core house unit. The structural frame can be expanded repeatedly in the future for once, twice, three times from the original frame.

Core houses in Kasongan and Kebon Agung have been extended in various stages. It can be categorized into core house expanded by repeating the structural unit within 1, 2, 3 or more structural frames. (See Fig. 7) The Kasongan case showed to us that the inhabitants were really active to expand their core house. They did not only add the core house with one structural frame, but also with two or three frames in almost equal number. In Kebon Agung, most of expanded core house were done by adding one more structural frame. The Kasongan case proved to us that core house has extend-ability towards three more repeated structural frame and even more. This means that the extend-ability of the structural frame would challenge the "ready one" added structural frame in both Kasongan and Kebon Agung to expand family living space need in the future (except if the lot size does not allow).

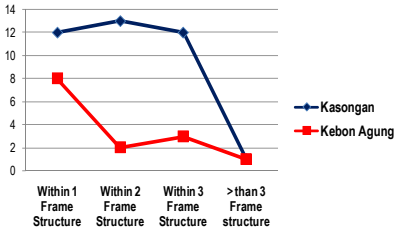

Figure 7. Repeated Structural Module of Extended Core House

By definition of Napier and Meiklejohn (1997) the core house implemented in Kasongan and Kebon Agung can be categorized as "*a habitable core house*" which contains all the main built components and is therefore habitable from the outset. The habitable core house can take the form of a shell house, a small core house or a multi-storey core house. By the standard of OHCHR-United Nation (2007) on *The Human Right to Adequate Housing*, *a habitable housing* should be provided to the inhabitants with adequate space and protect them from cold, damp, heat, rain, wind or other threats to health, structural hazards and disease vectors. The right to adequate housing is also to include and guarantee the physical safety of occupants. A balanced complementary between spatial needs and physical safety should also be considered in a core house design so that becomes important factors to develop both system of functional and of structural expandability. The balanced between structural strength and architectural living space, is also required by SPHERE's standard (2004) which includes the construction approach for disaster shelter in accordance with safe local building practices and maximises local livelihood opportunities.

The extension of the core house both in Kasongan and Kebon Agung can be understood by observing the direction and the number of structural frame added to the core house. Learning from the structural extension in Kasongan, most of the extended core house has been expanded to the direction toward the back part of the core house. (See Fig. 8) It is fit to the construction guide line of the core house extension. The result of expansion in Kasongan proved to us that the structural expansion can be in line with the functional extension needs of the inhabitant.

[3] See http://en.wikipedia.org/ wiki/Modular

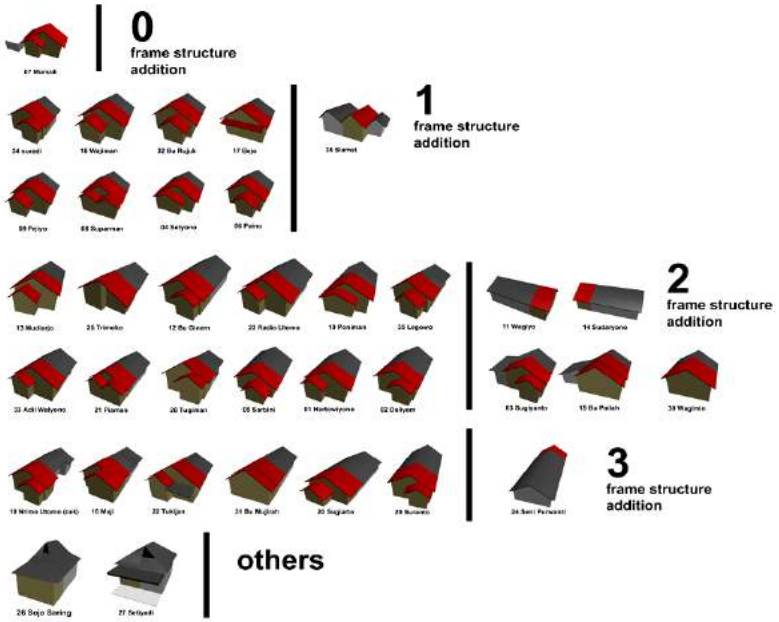

Figure 8. The Axonometric of Core House Extension in Kasongan

The Compliant & Non-Compliant Extension

The concept of extension can be used for many terms, but always related to act of expanding in scope or making more widely available. The plan extension means expanding a plan and making more available the square meter of a house or building. The extendability of a house relies on the design and its structure. The more the structural frame was extended, the more the family living space was added. The role of structural frame in expansion was highlighted by Leupen (2004) by proposing a concept for the changeability of dwellings based on permanent element i.e. "the frame". He explained that this permanent frame is embodies the building's most important architectural and cultural values, which means that building can react to changes in the requirements imposed on it over time without damaging its essential character.

Among extended core houses in Kasongan and Kebun Agung, it was found that there are two patterns of the expansion tendency. The first is a "compliant pattern" when the core house was extended in compliance with the guideline of structural frame extension, i.e. to the back part of core house. The second is a "non-compliant pattern" where the direction of the extension was not to the direction of the back part of the house. The "non-compliant pattern" could be developed to the direction of the left/right side of the house or a combination between to the back direction and to the left/right one. (See Fig. 9.)

Most of extended core houses in Kasongan and some in Kebon Agung were categorized into the "compliant pattern". These indicate that the core house design serves effectively to the real situation in the implementation. The plan extension can work properly with the structural module extension. The simple structural extension by repeating modular frame is believed to maintain the stability of structure to anticipate the coming earthquake. Meanwhile some of extended core houses categorized into the "non-compliant pattern" can be still seen as conforming to the structural module if the expansion direction goes toward left/right part of the core house instead of to the back part. The "non-compliant" part is more to the architecture rather than structure. The different architecture approach is indicated by the orientation of

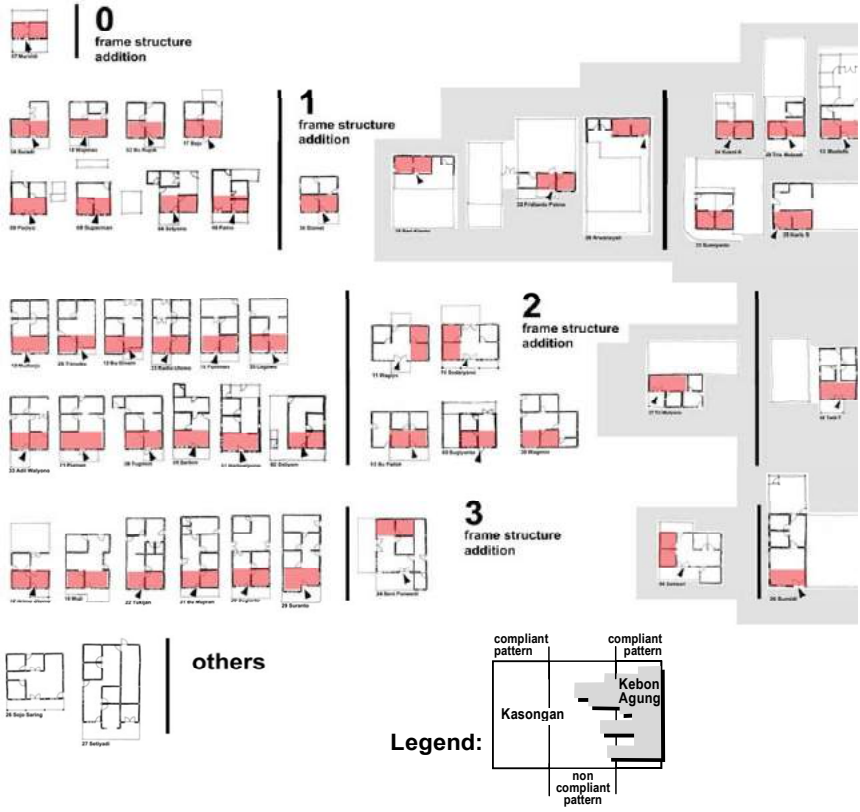

Figure 9. Plan Extension guided Through the Structural Module

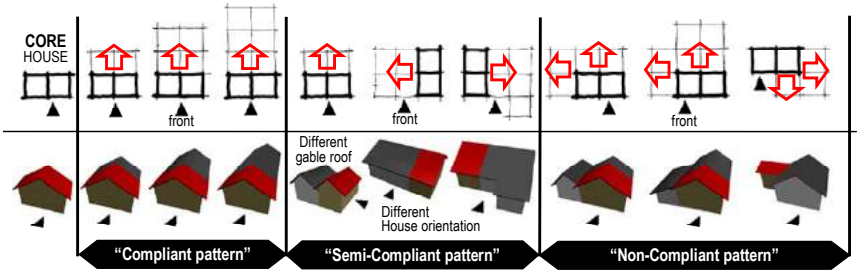

Figure 10. The Plan Extension within Structural Module Development

the house or roof architecture. The orientation of the house can be with its front part not on the roof gable but on the lower eave roof (at the length of house extension). The alternative roof architecture of the core house developed by community was found by making the gable roof on the width (3 meters) of the core house rather than on the length (6 meters). However, this sort of "semi non-compliant" pattern still keeps the module fit the structural frame extension. The "non-compliant" extended core house made two directions both to the back of the core house and to the side of the core house. The extension can be done first to the back part which consider as the main structural frame extension, then to the side part (left/right). In few cases, the extension's directions were irregular. (See Fig. 10).

In one hand, the variety of core house extension through structural module—"compliant pattern", "semi-compliant pattern", "non-compliant pattern", and the irregular one—would give flexibility to the core house design. But at the other hand, especially the case of "non-compliant pattern" and "irregular one" should be observed carefully whether the extension's result influenced the strength of structural frame due to the earthquake resistance requirement. Therefore, the flexibility in expansion should not only deal with the capacity to add square meters to the building later, (Spangenberg , 2004) but also how the extension could maintain the stability of the structure when the new structural frame was added.

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Findings of the study proved to us that the implemented core house has extend-ability through repeating a modular structural frame guiding by the extension plan. However, the two study cases showed a different tendency to extent the core house.

- The Fact that Kasongan core house was developed and growth further than one of Kebon Agung.
- Most of the Kasongan core house extension followed the compliant pattern which repeated modular structural frame so that the extension could maintain the stability of the structure when the new structural frame was added. Meanwhile, Kebon Agung core house extension grew into various tendencies. Some developed within "compliant pattern", some were within "semi-compliant pattern" and "non-compliant pattern"

The different time frame of implementation would be one of reason why the two cases have different tendency to extent the house. The different time frame of implementation influenced the technical aspect in different context. Reeth (2004) raised two issues as the most important prerequisite for (implemented) architecture so-called the context: The site and the time. He believed that these are the first and the most difficult conditions, to ascertain what is right in its context, in its place, is to determine which projects are just in time. Similar to what Reeth's mentioned above, technical aspects around the implementation of core house in Kasongan and Kebon Agung can be mentioned into three issues. First, it is related to time of implementation, second related to the site, and the last issue is related to the availability of supports and materials.

First issue, the different time of implementation between Kasongan and Kebon Agung influenced significantly to the core house implementation. The core house in Kasongan was constructed at first in August 2006 (about 2 months after the Java earthquake), while one in Kebon Agung was in February 2007 (around 9 months after disaster). The Kasongan's core house was constructed before the government reconstruction fund for about 180,000 totally damage's houses was distributed (October 2006), while the Kebon Agung's case was implemented after or during the government reconstruction's supports.

The different time of implementation caused the different situation faced by either donor or community who constructed the core house. In Kasongan, the need of house reconstruction was in very high demanded. The budget for a core house which was set at Rp. 10 million (1,100 US$) had to be distributed less than the plan due to wider beneficiaries target. It became Rp. 6,5 million (700 US$) per unit cost for 18 m^2. The beneficiaries in Kasongan had to contribute more for their core house construction. This made possible because at that time the materials from their damage house were still available and ready to be re-used or recycled.

The condition was completely different in Kebon Agung, the time after the beneficiaries' family got the support from government reconstruction fund. As we explained above, the beneficiaries in Kebon Agung were a family, who was a member of extended family suffered from same totally damaged house. Although they were supported by 36 m^2 house, they still lived in limited space for extended family. The situation in Kebon Agung raised the second issues on the site size availability. The core house in Kebun Agung was implemented mostly when the family has reconstructed their house by government fund. This means that the site has been already occupied a part or large part by reconstructed house. The core house should be put later on and considered the existing house. This situation was more difficult comparing with the

Kasongan's case which used the site relatively open and give challenge for do optimum lay-out of the core house setting. For some families, they decided to set the core house in different site of the main extended family. They provided an individual lot's site owned by the extended family.

The Kebon Agung also faced the lack of recycled materials availability to support the core house construction. Beside the materials' cost became more expensive in the post disaster reconstruction time, this can also be understood that the recycled materials belonged to family were used for the house reconstruction before the core house implementation. Those three issues—time, site and materials availability—will give the contextual frame work for the discussion of the core house development in this study.

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Fig. 01: Atelier Bow-Wow (2012)

Fig. 02: Diploma FS23 Living on Terraces, Hannah Kilian, ETHZ. Actor Network Drawing

Fig. 03: HS19 Yuni Zhao, ETHZ. Actor Network Drawing

Fig. 04: BUK Käferstein & Meister Architekten, Haus in Küssnacht

Fig. 05: BUK, ETHZ

Fig. 06: R. Masats (1955). Retrieved on 31.08.2021: https://www.theguardian.com/artanddesign/gallery/2020/jul/15/behind-the-bullfighters-ramon-masats-spain-in-pictures#img-8

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