



## **The role of urban change hierarchies in post-disaster recovery management**

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### **Abstract**

Despite a consensus within the multi-agency disaster management community that a collaborative and coordinated approach to post-disaster recovery is necessary, little agreement exists regarding its means of achievement. This paper examines the proposition that Habraken's (1998) theory of a hierarchical control model of urban change provides a sound basis for the development of such an approach.

Habraken (1998) identifies "levels" within the physical structure of the urban environment, assembles them into a hierarchy and peoples them with agents of change. Both built form and human agency exert control over the process of change, with the degree of control corresponding to their position within the hierarchy. The paper explores the relevance of this model, which is based on the assumption of continuing incremental urban change, in the very different context of post-disaster recovery.

Preliminary testing, by a pilot study, of the proposition has been completed. This took the form of a survey of survivors of the 2004 Asian tsunami, based on a questionnaire incorporating Habraken's hierarchical model. The respondents, who could not be expected to have prior knowledge of theoretical constructs of urban form, were asked to prioritize the levels of the hierarchy they wished to see as the focus of recovery activity. The results indicate a high level of correspondence between the phases of the post-disaster reconstruction process and the levels of the urban hierarchy. The paper concludes with a discussion of their relevance in the context of the New Zealand recovery framework.

Keywords: Recovery management, Hierarchy, Urban form

## Introduction

This paper investigates the degree of correspondence between the concept of levels evident in the fields of disaster management and urban planning, and that in N.J. Habraken's (1998) "Order of Physical Form", which provides a basis for his model of a hierarchy of control of urban change.

Habraken (1998), derives his model from, and locates it within, the "ordinary" living experience of the everyday urban environment. A disaster event represents the intrusion of the extraordinary into the ordinary. A new, post-disaster, everyday environment will emerge from the recovery process, but it cannot be identical to its pre-disaster predecessor – the collapsed hierarchy will be reassembled in a modified form. Members of the disaster management and the urban planning-urban design disciplines may be expected to play a major (and coordinated) role in its reconstruction.

As a key attribute claimed by the concept is its representation of an implicit understanding of urban form, the first part of the paper seeks evidence of its recognition in the legislation, regulations and guidelines issued by the upper levels of the control hierarchy and which form the operational framework for action within and between all levels. New Zealand is selected as an example, as it is both local and is considered to incorporate current "best practice" gained from other countries' experience. A brief summary of the survey is provided.

Recognition of the concept at the lower levels of the hierarchy, traditionally associated with "community participation", is tested in a survey of survivors of a major disaster (i.e. potential users of any proposed recovery system), carried out in Banda Aceh some six months after the tsunami of December 2004. Banda Aceh is selected as an example as it provides an opportunity to test the universal and intuitive aspects of the implicit understanding claimed as a basis of the model. A synopsis of the findings is provided. The detection of evidence of recognition in both surveys is considered necessary if the relevance of Habraken's model to the management process in post-disaster situations is to be supported.

### Habraken's hierarchy of control

Habraken's hierarchy of control is derived from, and parallel to, the scalar "order of form" common to all urban environments. In the order of form levels are identified within the physical structure of the built environment, decreasing in scale from major transport networks, through local street patterns, the urban block and buildings, to the room within the building and the furniture within the room. Both built form and human agency exert control over the process of change, with the degree of control corresponding to their position (i.e. level) within the hierarchy. Vertical relationships (i.e. between levels) are generally recognized and may be considered stable – "It is quite uncommon to find a furniture configuration dominating a building configuration, or a configuration of buildings dominating a street network. They seem to exhibit an inherent dominance/dependence relation as a formal imperative." (Habraken, 1998). Horizontal relationships (i.e. where many diverse agents congregate within a single level) exhibit increased volatility. The aftermath of a disaster is an extreme example of the collapse of the hierarchy into a single level.

The concept of levels aids comprehension of the reciprocal relationship between built form and human agency. Levels of physical form are readily associated with levels of government (national, regional, local, community) and with professional disciplines (highway engineers, town planners, architects, interior designers); with the scale of development providing clues to the scale of the developer. Habraken (1998) notes that: “By definition, the level represents a domain of control...Agents operate on different levels by virtue of what they control.” Agents are, of course, able to control more than one configuration, and are able to operate at more than one level, and at more than one location within a level. The role played by the agent will, however, be determined by the formal level of operation, as the determinant of the “rules of engagement”. The relationship between the levels of built form and agents acting within them is, therefore, not fixed. Although the scalar hierarchy of form has considerable stability, the composition of the levels, and of the hierarchy, can, and do, change; offering a degree of flexibility with the potential to adapt to unpredictable circumstances.

## **Research methods**

The research methods reflect the nature of the research: the testing of theory. The theory to be tested is Habraken’s (1998) hierarchy of control of urban change. The theory, based on the assumption of continuous incremental change, will be tested in unforeseen circumstances of post-disaster recovery management.

The case study methodology is adopted as it offers, through a careful selection of disaster sites, a precise focus and detailed examination of key aspects of the theory – in particular, those aspects that constitute its claim to relevance in the management of post-disaster recovery.

A fundamental claim of the theory is that it is not normative (i.e. it is non-judgemental) and this research project will adopt the same analytical approach. Data will be collected using a variety of sources and methods, and will be categorized in terms of its location within the hierarchy – that is, its appropriate level.

Categorization is seen as an important intermediate stage between data collection and analysis, as it provides a consistent and objective view of the data, and replicates the methodology of the theory under test. Accommodation of this data will require the modification of the hierarchy into a matrix, with levels of the hierarchy as one axis, and time (measured from the disaster event) as the other. (The levels of the hierarchy may, in order to meet the requirements of recovery operations, need further adaptation and/or addition as the research proceeds.) Initial analysis of the matrix will ascertain the existence of patterns of recovery activity. Further analysis will identify the agents of change, their positions within (or without) the affected community, and the control structure of which they are a part. The efficacy of the structure will be assessed against the criteria (i.e. claims of the theory): simplicity, efficiency, adaptability; as a measure of its resilience.

### **Case Study 1: Banda Aceh (Pilot Study)**

The Banda Aceh case study (pilot study) is designed to test the theory in the “real-life” conditions of the response-recovery phase of disaster management. It tests the claims of universality and intuitive understanding in conditions where the respondents, survivors of the 2004 Asian tsunami, could not be expected to have any prior knowledge of

Habraken's concept and model. The method used is a questionnaire, designed to allow the extraction of statistical information. The questionnaire, based on Habraken's hierarchy of control, asked the respondents to prioritize their expectations of the recovery process. Results of the pilot study are discussed below.

## **Research results**

### **Recognition of the concept of the Hierarchy of Control: Disaster Management**

Recognition of the concept of a hierarchy of levels is evident in the terminology of natural disaster. Most members of the public will, following the Asian tsunami of 2004, recognize levels of intensity (0–XII in the Modified Mercalli Scale), or of magnitude (0-unspecified, currently 9, on the Richter scale), in measuring the severity of earthquakes; and, following Katrina, 2005, the categories of hurricanes (1-5) on the Saffir Simpson scale of intensity.

The associated levels of emergency are, in New Zealand's Civil Defence and Emergency Management planning, categorized into five levels. The levels increase in scale from Level 1 (a local incident not requiring a declaration of emergency); through Levels 2 & 3 (where the local Emergency Operations Centre is partially or fully coordinating the management of the response); Level 4 (a regional emergency requiring coordination by the Group Emergency Operations Centre); to Level 5 (a state of national emergency where the National Crisis Management Centre exercises control). (MCDEM, 2002). Management functions, expressed as simple hierarchies, expand as the level increases.

A Level 4 event is the highest level to involve a single urban area. Using Auckland as an example, the hierarchy of control is headed by a Group Recovery Manager, appointed by the Auckland Region CDEM Group. The Group Recovery Manager coordinates the work of three support groups: the Recovery Taskforce; the Community and Sector Expert Reference Group; and the Recovery Action Group. Continuing down the hierarchy, the Recovery Action Group coordinates the work of several workgroups: Economic Environment; Social Environment; Built Environment; Natural Environment; Rural Environment. The Built Environment workgroup includes representatives from, amongst others, transport, infrastructure and building contractors' organisations and may (in common with the other workgroups) establish sub-task groups, in the case of the Built Environment based on land-use categories such as residential, commercial/industrial, public building and utilities. (ARC, 2005)

A similar but less extensive hierarchy exists at the local level (Level 3) with, for example, the Auckland City Council's Recovery Manager coordinating, through a Recovery Operations Centre, the workgroups for the Economic, Social, Built and Natural Environments.(ACC, 2005)

At Emergency Levels 1 & 2 the New Zealand Coordinated Management System (CIMS) uses a simplified hierarchy of an Incident Controller (collaborating, at the higher level, with the local Emergency Operations Centre) coordinating Planning/Intelligence, Operations, and Logistics sections and supported, in a multi-agency response, by individual agencies' (vertical) lines of command. A major objective has been the development of a common terminology, aimed at reducing confusion in communication between diverse agencies.(NZ Fire Service Commission, 1998).

It appears that, within the operational system of recovery, a consistently hierarchical approach is adopted; linked, through the levels of emergency, to levels of urban form.

### **Recognition of the concept of the Hierarchy of Control: Urban Design**

A key attribute of Habraken's (1998) concept of levels and associated urban control hierarchy is that, whilst accepting that agents' actions reflect their value judgements, it is itself non-judgemental. In this it differs from much of the recent urban planning literature, which favours a normative approach, usually based on principles of "good design" and focused, in New Zealand, on the emerging discipline of urban design.

The first "official" foray into this field, "People+Places+Spaces: A design guide for urban New Zealand" (MfE, 2002), is an example of this trend. It describes five design principles: Consolidation and dispersal; Integration and connectivity; Diversity and adaptability; Legibility and identity; Environmental responsiveness; which are derived from the generally accepted principles introduced by Bentley et al.(1985) in "Responsive Environments". (They reappear, in a further modified form, in the Urban Design Protocol: Context; Character; Choice; Connections; Custodianship; Collaboration. (MfE, 2005)). There is a recognition of the concept of levels: "When applying these design principles it is important to think about the different spatial "layers" a city or town has..." The nature of these layers is not specified, but a table of "Project Levels" is introduced later: Sub-regional structuring; Development frameworks; Site planning; Public space design; Private lot design; Building design; and these are combined with the design principles to produce a matrix intended to illustrate the range of issues relevant to project design. "Whatever level you are working at, it is vital to consider the issues at least one level up or down from it." (MfE, 2002). Although limited to the consideration of "project issues", these levels and those of Habraken can be considered to be broadly parallel.

The table of project levels is reproduced in Auckland City Council's Urban Design Strategy (2004) – an example of governmental inter-level communication. In this publication some similarities with the levels' influence on the rate of urban change – an integral feature of Habraken's control hierarchy – are evident: "Urban design is important at many levels – from the detailed design of a building, street or park to the large scale of regional structuring...In general, the higher and more public the scale (or level of development), the longer it needs to last and therefore the more important it is to get it right." (ACC, 2004).

There is, then, evidence that within the levels of government the concept of a hierarchy of levels is, although never explicitly referred to, implicitly acknowledged.

### **Recognition of the concept of the Hierarchy of Control: Pilot study, Banda Aceh**

This took the form of a survey, based on a questionnaire including Habraken's (1998) hierarchy of urban form (table 3.4, p.65). Each level of the hierarchy was defined by three explanations of its content: its specific (named) formal elements (e.g. roads); its assembly of elements into a generally recognizable configuration (e.g. building); and a description of the kinds of spaces thus formed (e.g. room). The intention was to provide as clear an explanation as possible, to as wide a range of people as possible, of the "meaning" of the levels. Respondents were asked to list, in order of priority, the levels which they wished to

see as the focus of relief/reconstruction activity in the three post-disaster phases of Response, Recovery and Rehabilitation. They were also asked to give reasons for their choices.

The survey was conducted by the authors in June-July 2005, with post-graduate students of law from Syiah Kuala University in Banda Aceh acting as interviewers. Earlier surveys had indicated that most interviewees would be illiterate, and oral interviews were conducted in Acehanese and recorded in Bahasa Indonesian, with the written transcripts later being translated into English. Ninety such interviews were completed, with seventy-three of them being finally used. A random sample of survivors of the tsunami, living in temporary camps in the vicinity of the city of Banda Aceh, were interviewed.

The results of the survey show a high degree of correlation between the phases of the post-disaster reconstruction process and the levels of the urban hierarchy. In the initial Response phase (0-3 months), there is a pronounced prioritization (76% of respondents) of action in the higher levels (6 & 5). This is focused on specific elements: in level 6 upon rebuilding major arteries (38%), in level 5 upon roads (35%). In the Recovery phase (3 months-2 years), the first priority moves down the hierarchy to the level of the building (49% at levels 4 & 3), with 45% nominating level 4's "building" definition. 34% of respondents retain level 6 as the first priority, but the focus shifts from the specific (major arteries) to the general (city structure =31%). In the Rehabilitation phase (2-15 years) the priorities continue to show a downward shift, with 35% selecting the level 2 definition of "place" (personal space). 50% retain level 6 as first priority, but the emphasis moves again, from the general to the social, with 37.5% nominating "neighbourhood". The results are summarised in Table 1 (see below).

<b>Level (Scale)</b>	<b>A Nominal (Named) Elements</b>	<b>B Configuration (group of elements)</b>	<b>C Spatial (social) Whole</b>	<b>Response Phase 0-3 months</b>	<b>Recovery Phase 3months-2years</b>	<b>Rehabilitation Phase 2-15 years</b>
<b>6</b>	Major arteries	City Structure	Neighbourhood	<b>38%</b>	<b>34%</b>	<b>50%</b>
<b>5</b>	Roads	District	Block	<b>38%</b>	<b>7%</b>	<b>7.5%</b>
<b>4</b>	Building elements	Building	"Built space"	<b>14%</b>	<b>47%</b>	<b>2.5%</b>
<b>3</b>	Partitioning	Floor plan	"Room"	<b>1.5%</b>	<b>2%</b>	<b>2.5%</b>
<b>2</b>	Furniture	Interior arrangement	"Place"	<b>7%</b>	<b>10%</b>	<b>35%</b>
<b>1</b>	Body and utensils			<b>1.5%</b>	<b>0%</b>	<b>2.5%</b>

**Table 1:** Summary of the Banda Aceh Survey.

The respondents clearly recognize an association of the phases of post-disaster reconstruction with the levels of the built environment, and with its hierarchy of control.

The prioritization of the rebuilding of specific elements of the physical infrastructure (e.g. major arteries and roads) indicates a need for major agencies (i.e. Government) to take a leading role in the initial Response phase. Key components of the network are identified, for example “To establish new bridges for good traffic.” Reasons given tend to stress the delivery of aid (and the evacuation of dead bodies); a natural concern in the immediate aftermath of a disaster.

Typical comments, for example “Easy to come aid”, “Easy to come transportation” and “To be easy for in entry the helper”, indicate an urgent need for communication with local and regional urban centres, and with national and international agencies.

Entry to and exit from the disaster zone were crucial in the Response stage. The data showed that there was a need for major arteries to get food supply in because food was not available or, where available, was very expensive. Fuel was also in short supply. Of concern was the need to make sure the injured and dead were cared for in an appropriate manner. The respondents were concerned that the authorities found a “place of health for plenty of ill/injured people.” Travel within the surrounding region was necessary “to facilitate to look for the family” and for “facilitating to evacuate the victims of tsunami.” A consistent feature of the reasons given by the respondents for their prioritization of the higher levels of the hierarchy was their concern that aid be immediately available to all members of the community.

During the Recovery phase the priorities move down the urban scale, and become focused on the rebuilding of housing and communal facilities such as hospitals and schools. At this stage, the respondents were beginning to think about a return to normality in their lives, and their concerns were that rebuilding cater not only for their residential needs but also for health, education, prayer and work. Reasons given stressed the need for: “a place for ill people treatment”; “a place to get education working”; “a religious service place”; and “to launch commerce”. There was a continuing concern for the care of survivors: “for the place of treatment of victim tsunami”; and an underlying sense of a need to feel safe and secure, with many mentions of “a safe place” and “a need to feel protected”.

A recognition of linkages between the middle level of “building” and the high level of “city structure” is apparent. Many respondents stated that the aim of rebuilding should be to improve on pre-disaster conditions. They expressed a desire to: “create a natty town”; that the “town structure need to create the regular town”; the “real correct town structure”; the “correct area for planning the buildings”; and “a perfect city structure”.

This wish re-occurs in the Rehabilitation phase as “town structure at area of tsunami re-arranged better”. Reasons given include: “to get the good environment”; “to look for environment which suited for society”; and “environment of vital importance to create the peaceful atmosphere for the place to be builded”. This desire for a peaceful society provides a context for the continued movement of priorities down and across the urban hierarchy to the individual “place” of home. The respondents’ expectations were of a “peaceful place” where people would have “safe places and good places to live.” By this stage people would be considering the neighbourhood and buildings within which they would re-establish their lives, and the need to have a “good place” to inhabit becomes a priority. Furnishing and occupying the home is an expression of personal identity, and identification of and with a neighbourhood an important facet of community.

These bottom levels of the hierarchy represent the traditional areas of maximum involvement of the community, and it is possible that the linkage between the decreasing (physical) scale of reconstruction priorities and the increasing length of time after the impact of the disaster represents an acknowledgement of the eventual withdrawal of relief agencies and of government (and media) attention. This does not, however, diminish the importance of the finding that the traditional levels of community involvement – those associated with local building production – achieve the highest priority in the recovery phase (that is, from three months after the disaster). Simultaneous activity within the levels appears, therefore, to be necessary from the commencement of the Recovery phase. The dominance-dependence relationship between levels, which allows activity at the lower levels to occur without constraining action in the higher, supports such concurrence. It also contributes to the community's degree of resilience, which may be measured in terms of the time taken in its re-establishment.

## **Discussion and conclusions**

### **Degree of recognition and implications for post-disaster recovery management**

The Banda Aceh results show a high degree of recognition of the concept of levels and of its usefulness in articulating priorities. The associated need for concurrent action in multiple levels of the hierarchy, and the interdependence of the social and physical fabric of the community, are also recognized.

Whilst the questionnaire makes no attempt to measure the capacity, or the desire, of the community to participate in the rebuilding, the results indicate a recognition of middle level local involvement in the Recovery phase, functioning in parallel with regional, national (and, perhaps, international) agencies operating at the higher levels. They also indicate support for Brewster's (2005) contention that "rapid action planning" is essential. Rebuilding of key community facilities such as hospitals and schools is expected to occur, together with house construction, as the first priority of the Recovery phase (i.e. starting three months after the disaster event), with the local building industry playing a significant role.

Buckle (2004) argues that local communities contain "a depth of knowledge and a range of skills that disaster management agencies and Governments have not begun to use effectively." Both the Banda Aceh and the "operational framework" surveys lend credence to his views.

Recognition of the concept of levels is also evident in the New Zealand disaster management and urban planning operational frameworks, as is an espousal of community participation. "Focus on Recovery: A Holistic Framework for Recovery in New Zealand" (MCDEM, 2005) promotes the aim of the CDEM Act (2002) to build "resilient New Zealand communities", and the National CDEM Strategy's (2004) affirmation that "the heart of recovery is community participation". (Rotimi et al.,2006). It notes, however, that "One of the inherent difficulties in ensuring community participation following a disaster is the need for rapid redevelopment. Conflict is likely to arise as a result of this tension between the competing need for a rapid rebuilding process and adequate consultation in its development and implementation." (MCDEM,2005). In this document "community" is considered almost solely as a social construct, and the built environment



largely in terms of land use, with specific mention of urban planning being limited to infrastructure. The Banda Aceh respondents (with the aid of Habraken's model) recognize not only a wider definition (of urban planning) at the higher levels but also its concurrent influence at the middle levels; with the associated activity of building becoming a physical means to social ends.

The New Zealand document acknowledges input from the Australian Emergency Manual: Disaster Recovery (EMA, 1996/2004). This includes a summary of the proceedings of "a symposium for urban planners held in the US in 1990 [which] provides a range of lessons for those involved in the redevelopment of communities following disaster." (Spangle, 1991). It lists, under the heading "Urban Form and Design", a number of key findings that include: "Cities and towns are almost never relocated; Neighbourhood preservation can help personal and community recovery; Design is everybody's business." This section appears to have been overlooked in the drafting of the New Zealand legislation and guidelines, and its omission may contribute to a continuation of the lack of integration between urban planning and disaster management cited by Ericksen (1998) in his historical survey of collaboration between urban planning and disaster management personnel in New Zealand's local authorities, who notes that it is "almost non-existent". Wamsler (2005) confirms that "disaster people perceive urban planning only as an issue of land use zoning and of building regulations..."

The findings of the Banda Aceh survey support those of Spangle. The respondents display a clear appreciation of the need for coordinated action in the speedy reconstruction of their "natty town". This is particularly apparent in their priorities for the Recovery phase.

The Australian document encourages community participation in recovery planning by stressing that: "recovery management is no different from any other form of public sector management, it's just that decisions are made within a shorter time frame", noting that "agency recovery roles should preferably require only minor deviations from their normal functions", and that recovery plans "should be as simple as possible". "Normal" and "simple" are qualities that can be ascribed to the hierarchical model.

As noted above, Habraken (1998) derives his concept of levels from, and locates it within, the "ordinary" living experience of the everyday urban environment. Its derivation from the hierarchical structures of complex systems (Habraken, 1988a, 1987; see also, for example, Banai, 1995; Reed & Harvey, 1992) supports the premise that such ordering is a fundamental aspect of human cognition. "Levels clarify intuitive understanding." (Habraken, 1998)

The control hierarchy concept is described as a "new model" in an investigation of the provision of shelter for the homeless (Habraken, 1988b) – a topic of particular relevance to disaster management. Although the model is new, the understanding on which it is based is not. There is a tacit understanding (a feature of shared knowledge) of the dominance-dependence relationship of urban levels. Advocating freedom of control for builders and occupiers within the lower levels, Habraken (1988b) notes that this will not constrain action at higher levels, but permit the achievement of simultaneous (i.e. time-saving) operation at multiple levels. This is, of course, relevant to the findings of the Banda Aceh pilot study.

The Banda Aceh survey provides insights into the needs and aspirations of disaster survivors that are not normally available to disaster managers and urban planners. It illustrates an understanding of the role(s) of agencies in the achievement of reconstruction priorities that has, perhaps, been previously unrecognized. This, it appears, has been facilitated by the model of the concept of levels; which elicits, and makes explicit, intuitive or implicit knowledge. The findings support, therefore, the proposition that the hierarchy of control, as a simple model of the concept of levels, can contribute to the management of post-disaster recovery activities.

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