

PREFABRICATED HOUSING AND THE IMPLICATIONS FOR PERSONAL CONNECTION

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ABSTRACT

One of the earliest forms of prefabricated building technology still in use today is the balloon (timber stud) wall frame, believed to have first been used around two hundred years ago and even now the concealed skeletal basis of the vast majority of contemporary Australian housing. Whilst much of current residential construction is prefabricated in some way, the housing industry is yet to industrialise the process on a large scale. Often heralded as a potential solution to the complex problems of meeting the needs of both housing demand and affordability, prefabricated housing is yet to be fully adopted in the Australian suburbs. Perhaps it is because much of systematised construction fails to provide the personal connection we seek with our dwellings. If so, it may be that the success of a prefabricated response to housing needs lies, then, in a rethinking of how its very building methodology might facilitate a greater sense of space and place in the dwellings produced. This paper discusses these issues in the context of disaster relief – conditions where prefabricated building responses are often preferred. It argues that in post-disaster situations, design matters, and it offers four objectives to rethink how the design of disaster relief and recovery buildings might be approached. If architectural delight – that which engages us with our built surroundings – can be enabled in and by prefabricated buildings in something as complex as emergency housing, then the potential for expanding prefabrication in our general housing could be significant.

Keywords: prefabrication, architectural delight, place and space, emergency housing, recovery housing

FUTURE FLASHBACK

We have been dreaming of a robotic future since we were first introduced to Robby in *Forbidden Planet* [1956]. But, curiously, that future has arrived without anyone noticing. And more ironically, many young architects today dream of a tomorrow that is already here (Lynn, 2008, p. 252).

Building in a prefabricated manner, often associated with the adoption of technology and advances in contemporary production, is by no means a new concept. One of the earliest forms of prefabricated building technology still in use today is the balloon or timber stud wall frame, commonly believed to have first been used *en masse* around 1833 in Chicago, although possibly having derived from a building technique introduced to America by French migrants as early as 1804 (Cavanagh, 1997). The principle of this new technology was to build lightly, quickly, and thereby cheaply through the utilisation of readily available long timbers milled to length and nailed together by unskilled carpenters or indeed, by the untrained building owners themselves. Having removed the need for bespoke joinery connections, entire walls could be fabricated as single full height timber units over multiple storeys, tilted into place and completed with floor frames that would be side-fixed at a later stage with simple nailed fixings. This methodology saw a move away from traditional timber joinery, whereby only skilled carpenters could piece components together through a series of carefully sculpted mortise and tenon joints (Giedion, 1967). Suddenly, building could become industrialised: simple, efficient, non-wasteful and inexpensive. Significantly, it could also be procured through a greater network of lesser-skilled tradespeople in an atmosphere of speed and ease over craft.

Today, we may not have long old growth timbers with which to build over two or more storeys, but the balloon frame concept's legacy remains in the contemporary light timber framing of our suburbs, where upper floor timber platforms sit on single story stud walls below. The balloon frame concept has seen a shift away from massive sedentary structures, where the structure itself forms the building skin, towards one of a skeletal frame that receives its skin in the form of any number of lightweight cladding and lining choices. In many respects, such mass customisation is something to which we still aspire in our buildings. Two hundred years after the balloon frame, the ideals of prefabrication are something we still strive to achieve, arguably as if this thinking is something new.

What has changed in that two hundred years is the mechanisation of manufacturing processes. Where the initial shift in construction techniques may have been away from craft-based carpentry towards that of non-skilled labour, Fordism saw the rise of the production line, where construction efficiencies could be achieved through the combination of machined components assembled by task-dedicated workers. This relationship of product to worker was reciprocal: mass manufacturing enabled goods to be affordable to those who ultimately produced them in an arrangement of by-the-worker-for-the-worker (De Grazia, 2005).

In more recent times the production line teams have made way for robotised assembly and whilst such construction advances are evident to us today in the making of products such as our mobile phones and cars, the technological change in the way in which we assemble our buildings has been more glacial. For American architect Greg Lynn, the method with which we design is decades behind the methods with which we can potentially build (2008). Where the manufacturing industry was quick to embrace technologies such as Computer Numerical Control (CNC) cutting and now benefits from decades of practice-based research, the building industry has been slower to react. Whilst small scale building items such as joinery may result from a computerised machined process, fabrication of the building itself by machines is still in relative infancy when compared with other industries.

Much of Lynn's work is experimental in nature but it points to a potential architecture that is not only *of* its time but *for* its time and beyond. Lynn describes his work as form making (both strictly architectural and in the allied design streams within which he works) 'as a means of connecting with popular culture' (2008, p. 210). If much of prefabricated architecture masks its innate building fabric, Lynn's is design that relies on the expression of its generative technique. This is evidenced in such projects as the Embryological House – a hypothetical project to design one-of-a-kind individual houses from within a set of predefined digital parameters, where a singular highly programmed animation software system provides a diversity of formal outcomes. What results is architectural form shaped by the algorithms of the computer. Lynn's so-called 'blob' architecture – in a way both formless and yet fully recognized by its idiosyncratic curved three dimensional shapes – is prefabrication that attempts to move away from the strictly orthogonal and predictable. This is architectural prefabrication attempting to explore the limits of its medium through maximum mass customisation: where the input of data not only affects the colour and pattern of the building, but its overall physical form and presence.

By contrast, much of contemporary prefabricated architecture appears embedded in a methodology that attempts to conceal its mechanics rather than celebrate or exploit them. Prefabricated dwellings often present as camouflaged bespoke offerings that differ only in the manner in which they are procured. This can be evidenced in any number of

prefabricated buildings that are praised for the fact that one would never guess them to be ready-made. Such projects – often realised as stand-alone ‘pods’ – attempt to recreate traditional on-site building methodology within a factory setting and focus on using prefabrication as a means of providing the consumer with quality control, time and cost benefits. In short, the architectural intention appears to be one of denying the occupant a tacit understanding of how the building fabric came to be: an architectural ‘business as usual’, as if the architecture that results from prefabricated building methodologies is something of which to be ashamed; perceived of, perhaps, as less of a building.

Perhaps the most aesthetically unambiguous example of prefabrication in architecture is the shipping container. Built to International Organization for Standardization (ISO) set dimensions, freight containers by nature are designed for the best fit across the multiple delivery platforms of land, sea and air. They are understandably designed to be robust, durable, reusable and relocatable; traits often desired in prefabricated buildings. But whilst these qualities can clearly be beneficial when applied to buildings, particularly where a structure is required to be transportable, containers are inherently limited in the way in which their forms and internal spaces can be adapted for human occupation; they are, of course, ultimately “contained”. The designer must eventually yield to working within the constraints of the unit’s dimensions, structure and materiality – too much adaptation and the given framework of the container is lost and it’s *raison d’être* as a building, denied.

Sited between the extremes of Lynn’s free forms at one end of the fabrication spectrum and unitised ‘pods’ at the other is the work of architects Kieran Timberlake, whose Loblolly and Cellophane Houses are designed as much for their eventual disassembly as for their originating assembly. These are demonstration houses that use sophisticated sequences of components and connections to achieve forms and spaces of equivalence to spot-built projects. The demountable outcome relies on the viability of a system of dry connections and the resultant forms are ones that express how the kits of parts come together to form the prefabricated whole. This is particularly evident in the case of the Cellophane House, where the building’s aesthetic results directly from its exposed structure and transparent envelope. Through fully expressing the mechanics of the house, the architects argue for an architecture of craft over systematised process:

We have absolutely no interest in the process of architecture for the sake of process itself. What motivates us is the art of architecture - the making of beautiful buildings that elevate us all through the fusion of purpose with place, craft and ethical design (Kieran & Timberlake, 2007).

Herein lies the potential dilemma for architectural prefabrication, particularly where a speculative, pre-emptive building system is proposed in lieu of designing a singular building for a singular client in response to a direct invitation. Rather than deny the individualities of prefabricated buildings in general and prefabricated dwellings in particular, might an architecture grounded in the technology of manufacturing actually enable varied design intimacies to be orchestrated? And how might the resultant architecture feed into and from technologies from disparate non-architectural manufacturing fields? Might a manufactured assembly design system provide a technological and space generating alternative that not only speaks of its mechanics but provides the individual with the flexibility to make a systematised building personal?

Prefabrication appears to make economic sense: it has the potential to be designed as a known entity with minimal wastage and rapid, quality-controlled construction. But it appears that at the heart of prefabrication lies a dilemma: in the absence of a personal connection with its patron, can an architecture of the individual permeate the mass production means by which it is created?

THE PROBLEM WITH ‘PREFABRICATION’

‘Prefabrication’ is a loaded term; loaded, in that its ownership lies across the breadth of almost all manufacturing, and in the context of our architecture, burdened with the often stereotypical building images the word can conjure. When discussing the potential for *architectural* prefabrication, often the imagined outcomes are thought of in terms of the method’s limits rather than its opportunities. Perhaps the predominant perception and understanding of the prefabricated building is that of the module, whose proportions and form result from the necessary means by which they are transported and moved into place rather than by an individual design response for a particular person in a predetermined place. Arguably, this constrained architectural condition is no more acutely felt than in our dwellings, where a ‘one size fits all’ approach clashes with the idea of the home being an expression of the individualised self. When multiplied across a neighbourhood, such built repetition risks a sense of placelessness, where the identity of a community becomes diluted across allotments.

For architectural theorist Dora Epstein Jones, the speed and price advantages of prefabrication present an architectural problem:

. . . avoid “fast and cheap” if what you want, at the end of the day, is architecture. If architecture has had episodic encounters with prefabrication, historical spasms that momentarily celebrate and herald prefabrication, and then just as quickly disappear again; then it is likely that there is a great limiting factor . . . the single-module, reinforced by mass-production operations and ethos, may be that factor, always running short of the expressive need of architecture (2010, p. 613).

Jones is a Principal of Jones Partners Architecture, an internationally recognised firm with a widely published body of work that includes the shipping container typology. JPA’s PRO/con (PROgram conTAINER) system utilises the standard ISO twenty feet long shipping container as the basis for both stand-alone and agglomerated modular buildings that meld particular programmatic or usage requirements within the set dimensions of the given container. Whilst JPA’s architectural reinterpretation of the container is sophisticated and the domestic spaces created highly considered, Epstein Jones’ writings on prefabrication reflect upon the inherent limitations of the medium in general and the modular unit in particular. She describes the condition whereby prefabrication ‘stop(s) short of the value-added attractiveness that design brings to the equation’ (2010, p. 606). This statement warrants interrogation.

“Attractiveness” is a potentially problematic term in the context of a discussion of architecture, as what one person describes as architecturally “attractive” might equally be described by another as something entirely different. Substitute the word “attractive” with “beautiful” and the dilemma becomes more apparent: it is open to interpretation and personal argument either for or against. In addition, it becomes difficult to distinguish the parameters by which “beauty” itself is being measured: are we measuring the beauty of the building against that of the landscape, that of other buildings, or merely certain aspects of the building against other aspects of itself? “Attractiveness” or “beauty” also risk suggesting an applied decoration rather than something inherent within the fabric and/or form of the building that cannot be changed without fundamentally changing the building itself (consider soft furnishings and removable finishes compared with fixed, sculpted volumetric space). In invoking attractiveness, perhaps what Jones is implying is what was first described by Vitruvius around 30-20 BC as *venustas* (Vitruvius, Rowland, Dewar & Howe, 1999).

VENUSTAS

Vitruvius’ *De Architectura* or *The Ten Books of Architecture*, written for Caesar Augustus (Octavian) as what is generally recognised as the first treatise on architecture, was an attempt to formalise architects’ knowledge not just on building design, materials and construction, but on associated technologies and infrastructures of which Vitruvius felt architects should be aware. In relation to buildings themselves, Vitruvius stated that architecture consists of three parts: *firmitas*, *utilitas* and *venustas*. Ranulph Glanville describes the first English translation of Vitruvius’ original Latin as occurring in 1624 by Sir Henry Wotton, which resulted in what we know today as Vitruvius’ three architectural principles of *firmness*, *commodity* and *delight* (Glanville, 2009). Glanville comments that *firmness* might today be thought of as “well-built” and *commodity*, “fit-for-purpose” – ideals that are ‘relatively easy to specify and test for’ (2009, p. 177). In other words, these are measurable, definable outcomes: the building has determinable degrees of functionality measured against its instigating brief. “Delight”, however, is something altogether more elusive. Like “attractiveness” or “beauty” – the latter of which is often used as a substitute for Wotton’s Vitruvian translation to “delight” – the term is ultimately subjective and one over which individuals may only ever be able to argue for or against.

Definitions of what draws us to some buildings in more powerfully positive ways than others have been attempted before, from the likes of John Ruskin’s nineteenth century writings on what constitutes beauty (Evans, 1980), to Christopher Alexander’s contemporary ‘Fifteen Fundamental Properties’ common to buildings ‘which have life’ (2002, p. 144). Glanville, however, does attempt to make a simple, overarching definition of architectural “delight”, the provision of which he describes as ‘the central act of design’; an act ‘which generates novelty and assimilates and accommodates complexity . . .’ (2009, p. 176). When thought of in this way, one might begin to argue that “delight” is that aspect of architecture which evokes a positive response by offering an idiosyncratic culmination of elements in that singular place at that particular time. A simpler description might be that this building-as-object and the spaces it creates, both inside and out, are unlike any other I’ve experienced, even though it most probably resembles buildings I’ve witnessed before. Divorced from pure aesthetic or decorative judgements, “delight” might be thought of as that which gives rise to the sense of unique architectural space and place.

Recalling the conversation theory of Gordon Pask (1976), Glanville speaks of the “central act of design” in the context of a design “conversation” into which the architect enters during the process of drawing. This is fundamentally an inward conversation the designer has with one’s self in a process of iterative thought. This is described by Glanville as a series of ‘What if?’ questions in a strategy of ‘make a mark, view it, remake [change] the mark, review it’ (2009, p.

178-9). This theory of design thinking echoes Lily Chi, who discusses Peter Schneider's observations of 'drawing as a speculative capacity – one distinct from building or drawing-for-building' (2007, p. 7). Common here, is the notion that designing is a thoughtful act of repetition, questioning and re-questioning of one's assumptions and design responses. Rather than only working towards making the building well built and fit-for-purpose, the architect works iteratively to pursue Epstein Jones' architectural "expressive need" or Vitruvius' "delight".

DELIGHT IN THE PREFABRICATED

Such a design strategy arguably has different meanings when responding to an elicited brief from a known client to designing a prefabricated architectural solution for a non-specific building occupier. In a traditional patron-architect relationship the architect's design dialogue will not only be a series of "what if ..." questioning of one's self, but of a direct questioning of and responding to the building's commissioning owner as the design process develops. When this client role is expanded to include potentially anyone and in an unknown number of different places, the design object becomes more universal and oftentimes more generic. Whilst this issue is not solely the domain of prefabricated buildings – the general housing market is but one example – the repetitive, manufactured nature of prefabrication heightens the condition. Of course, not all prefabrication in architecture is the same and many one-off projects are designed to be built in a prefabricated fashion. For the sake of clarity, I am specifically referring here to that type of prefabricated architecture that is proposed as universal and repeatable rather than bespoke.

If the inherent mechanics that provide the speed and price advantages of prefabrication present an architectural problem – one where the built results of systematised construction often fail to provide the personal connection we seek with our architecture – then the problem becomes more concentrated in our dwellings. Furthermore, it becomes most acute when those dwelling conditions are under stress. Perhaps the most stressful of all such conditions is in the aftermath of a natural disaster. The most common response to disaster relief or emergency housing is that of the prefabricated unit, often conceived of and delivered as a ready-to-go pod. As an emergency response, this makes sense. In the space of hours, even minutes, communities can lose their entire building stock and be faced with the immediate need to be provided with architecture in its most primitive form: shelter.

Within such a scenario it might be assumed that the urgent need for shelter created by disaster conditions means that there is no place for thoughts of the architecturally "delightful". I would argue that people living in disaster conditions are perhaps the most likely to benefit from design that delivers more than mere shelter.

In *Beyond Shelter: Architecture for Crisis*, Victoria Harris laments the public perception of architects and their diminished role in the rebuilding of disaster-affected communities:

At best, the public sees architects as artists, at worst as superfluous – profligate spenders charged with executing the whims and fancies of a client's vision. And heaven knows the press and media outlets have not helped change this perception. If the online reader comments on an article published in *CNN Opinion* after the massive Haiti earthquake in 2010 are any indication, many people think that architects exist to "make things look pretty" (Aquilino, 2011, p. 13).

Harris is a founder of Article 25, a UK-based charity specifically targeting the built environment in disaster situations through the offering of design consultancy services to nongovernmental organisations. She describes the dilemma NGOs often face when being provided with funding for building reconstruction projects of which they have little or no experience. Harris points to the fact that architects are often left out of the reconstruction process in disaster situations and that when they are included, the translation of their professional expertise does not filter down to the local trades undertaking the building work. She outlines that:

The architect is the professional whose role it is to manage all the parties on a project. Architects are designers and builders, certainly, but they are also expert contract managers, able to see the arc of a project. Architects are the party responsible for taking the budget and resources available to a credible, pertinent, long-term built solution, along an optimal path (Aquilino, 2011, p. 13).

In the context of this discussion, Harris' comments would imply that the missing qualities architects can bring to the disaster relief building are those of being well-built and fit-for-purpose. Continuing this thread, the premise that the role of the *architect* is undervalued in disaster relief situations might be taken to its logical conclusion that the role of *architecture itself* is undervalued, particularly when architecture in these circumstances is defined by its tangible, well-

built traits. Small steps are likely to be required. Given Harris' identified difficulties of establishing the architect's role in helping to deliver appropriate disaster relief and recovery buildings, establishing an architecture that affords delight in these circumstances may be some way off being realised.

THE CARDBOARD CATHEDRAL

My city is levelled, and all I can say at the moment (*is*), bulldoze them all, only the cathedral needs to be rebuilt. I'm all for heritage but not at this cost (Anonymous, 2011).

When the city of Christchurch in New Zealand was affected by its second major earthquake in less than six months on 22 February 2011, preceded and then followed by several high magnitude aftershocks, much of the city's infrastructure was severely damaged, including over half of the city's CBD buildings and more than 100,000 suburban houses (CERA, 2011, p. 9). One of the more notable buildings damaged was Christchurch Cathedral, sited in Cathedral Square as the centrepiece of the city's original Anglican settlement. Amongst the disaster relief proposals for the city is the "Cardboard Cathedral" by Japanese architect Shigeru Ban. At a conceptual stage at the time of writing, the building's form is largely derived from its steeply pitched gabled roof, common to the traditional cathedral typology, and project images suggest a light filled contemplative space that creates a significant raked volume of some 20m in height. Ban's proposal, which will seat over 700 parishioners, is to be constructed of sixty-four 830mm diameter cardboard tubes, to be built by volunteers over a period of three months at a cost of NZ \$4 million. An additional NZ \$50,000 is allocated for a feasibility study (ChristChurch Cathedral New Zealand, 2011). Putting these monetary values in perspective, the proposed cost of the cathedral is less than 0.03% of the \$15 billion the New Zealand Treasury estimates repairing, replacing or renewing damaged properties will cost as a minimum (CERA, 2011 summary report, p. 8).

Ban's body of work using paper and cardboard materials in both non-disaster and disaster affected conditions is well documented (Miyake, Luna & Gould, 2009) and includes exhibition spaces, general housing and disaster relief housing. Followers of his work would not be surprised by seeing his design with the medium extend to New Zealand in the form of a cathedral for crisis conditions. But even those familiar with the precedents established in Ban's paper architecture can be critical, such as architecture critic Elizabeth Farrelly:

Shigeru Ban has achieved global celebrity out of humanitarian modesty itself. Kobe, Turkey, Sri Lanka, China – Ban is always there and he always gets his gig . . . Ban told the people "you need to build a new Christchurch, not just bring back the previous one". Never mind the logic of taking a useful and durable building material [wood] and applying vast amounts of energy and water to render it vastly less durable and useful as cardboard. Ban is proof that, in architecture, nothing succeeds like a gimmick (2011).

One might infer from such commentary that, when faced with disaster recovery conditions, attempts at delivering architecture beyond the basic needs of emergency provisions subjects the architect to perhaps greater scrutiny than that to which they might normally be exposed. Put another way, what one might call the provision of architectural delight requires greater justification in disaster recovery circumstances than in times of stability.

When notice of Ban's cathedral proposal was released, online public commentary reflected polarised attitudes (The Press staff writer, 2011). Criticism and praise were offered in two general themes: that of the appropriateness of the architecture and, as might be expected, that of the secular versus the religious. With some of the commentary (both for and against) it is difficult to determine to what extent the respondents' personal positions on religion influenced their opinion of the architectural proposal. For the purposes of discussion here, it is assumed that it is possible to consider the proposal objectively. That is, that it is possible to take a secular standpoint and still support the design proposal and that it is possible to support a religious position yet not the building. For the sake of comparison, I am excluding any comments from readers that made an explicit reference to the church as a body or religion itself either positively or negatively.

Support for the Cardboard Cathedral included comments such as 'finally some hope, the beacon for the reconstruction' and 'genius . . . a wonderful solution to stop the gap until the cathedral is rebuilt'. These would suggest responses from people neither familiar with Ban's work nor from inside the architecture industry. Further support was given by those urging fellow readers to suspend their criticisms and research Ban's body of work with paper architecture in order to understand the context within which this cathedral proposal was offered.

In comparison, negative commentary included ‘will this building meet with (the) building code? What about the risk of fire?’ and ‘wow...I have seen it all now....that is ridiculous’. Such reactions are understandable, assuming this news report is the first time some people have been made aware of buildings such as this. Of more interest in the context of this paper is the type of reaction that relates the opinion of the architecture proposition to the actual conditions of the city, epitomised by ‘Amanda’:

If we didn't have people still struggling in this city - effectively camping in their own houses - I would have thought this was an amazing idea. However the reality of the situation at the moment is that the \$4,000,000.00 could be better spent elsewhere in this community (*at*) the moment. I appreciate that the congregation would like a space to call their own to worship at again - but that too will come with time. It would seem that in an effort to restore some "normality" to the city - commonsense is taking a back seat (The Press staff writer, 2011).

It is commentary such as this that highlights the acute nature of housing conditions in crisis situations: although the money allocated to the cathedral is arguably negligible in the context of the overall reconstruction costs for the city, it is anything *but* when considered as a lump sum that might otherwise be put against housing provision. This points to the dilemma for the architect who, in crisis conditions, attempts to engage with the rebuilding task at hand with anything other than the immediate perfunctory, essential shelter response. Although the value-added benefits of architectural delight are understood, such buildings are not automatically accepted when it appears to come at the expense of the quick, robust, fit-for-purpose and necessary. when re-establishing an entire community with all of its fully rounded cultural capital, the need for the critical may ultimately trump the desire for the delightful.

DESIGN MATTERS

This begs the question: why not both?

My discussion here began with a brief and deliberately broad examination of prefabrication in architecture and (albeit with notable exceptions) its tendency to produce buildings that fall short of the connection we traditionally seek in our built environment, particularly in the most personal of our buildings – our dwellings. For the sake of exploration I have attempted to define that “something” with which we seek a connection as architectural delight and have discussed this in the context of crisis situations, where prefabricated solutions are often preferred. Shigeru Ban’s cardboard architecture proposal for Christchurch presents as a well considered and *delightful* prefabricated civic response to a city faced with a devastated town centre and surrounds. And although it has the obvious potential to divide opinion on religious grounds, I would argue that it forms part of a greater network of requisite social capital that includes cultural, sporting, educational and health facilities. Whilst not a dwelling, or indeed, because it is distinctly *not* a dwelling, it illustrates the difficulty of pulling rebuilding focus away from the most immediate occupancy needs of the community, particularly when the object of discussion is deemed to suffer from unnecessary architectural affectation.

In response to the unprecedented disaster conditions faced by the country in the wake of the Canterbury (Christchurch) earthquakes, The New Zealand Department of Building and Housing published its Request For Proposal for temporary residential buildings (New Zealand Department of Building and Housing, 2011). This document called for proposals for the ‘provision of up to 5000 units of pre-fabricated Temporary Accommodation units . . . (*including*) the disposal of the Temporary Accommodation once it is no longer required’ (2011, p. 3). The units were to be located either on dedicated communal sites or on affected individual private blocks. Jennian Homes, an established New Zealand volume home builder, was one of the successful tenderers, with their prefabricated modular homes purpose-built over a period of several months in response to the Request For Proposal for approximately NZ \$85,000 each (Gibson, 2011). The structures, available either as fully self contained houses or as utilities facilities for those remaining on their own sites in damaged houses, are of a generic transportable building typology: an elevated floor level accessed by open timber steps, lightweight clad walls and a symmetrical gabled roof form.

What this process highlights is the inherent difficulty in responding to crises when a community is not prepared. This is by no means a criticism of the New Zealand government’s reaction to the earthquakes: in the absence of experience in dealing with such a natural disaster, a government mobilises as best it can and will always be playing catch-up. The fact that generic prefabricated buildings are being purpose built over a period of several months only to be removed again in favour of permanent reconstruction is arguably beside the point when many in a community are displaced and require housing now. This may be double-handling of the housing recovery process, but it goes some way to meeting the immediate needs. In this recovery model, any provision of delight will be hoped for in the eventual permanent replacements; for now, such notions are extraneous and therefore on hold.

Learning from Christchurch and returning to the question at hand: rather than treating emergency housing and recovery housing as two independent entities, the opportunity exists to make them one and the same. This thinking has already been seen to some extent in response to Victoria's "Black Saturday" Bushfires of 2009. 1:1 Architects' House Re-Growth pod is a singular concrete unit designed both as an emergency shelter and as the basis for a permanent rebuilding project (1:1 Architects, 2009). If similar thinking was applied to a prefabricated system consisting of components and connections rather than static modules, we might see conditions in post-disaster areas whereby the rebuilding can commence immediately and in stages as resources, money and changing physical conditions evolve on the ground. Furthermore, rather than be a temporary fix, such a system might form the basis for permanent replacement buildings. Ideally, the system would also be flexible enough to allow for adaptation as the occupant moves from crisis mode to recovery and finds that what worked in disaster mode then is better suited to a new configuration in the recovery phase now.

Importantly, the inherent qualities of such a system might facilitate the delight we seek in our buildings without being seen as an optional accessory.

I offer that for this shift in thinking to occur – for emergency buildings to not merely function adequately, cheaply and quickly but to also be enthusiastically adopted, retained, grown and altered over time by those re-establishing after crisis – the following thinking needs to be considered and addressed at the outset:

1. *The starting point of designing spaces people want to occupy should be from the perspective of the occupant, not from the dimensions of transport equipment.*

When considering the design of prefabricated buildings, the design of our spaces (particularly our dwellings) is not necessarily commensurate with the dimensions of the transportation devices that deliver that building to site. Arguably, when people are at their most vulnerable, we should not be designing spaces for them based on what will fit on the back of a truck.

2. *The starting point of designing the building form should not be that which will most easily stack and rack.*

The fixed module is efficient for transportation and potentially easier to construct than a free form, but these performance parameters are only one (arguably small) part of the lifespan and economy of a building. The homogenous is a limited and limiting starting point when rebuilding communities.

3. *Complexity can allow opportunity.*

A prefabricated system should offer sufficient complexity so as to afford the architect the ability to generate multiple design outcomes. A system with some level of embedded complexity allows the creation of non-generic spaces and forms and may be a trigger for the activation of delight in post-disaster buildings.

4. *New technologies should be embraced.*

Rebuilding after disasters can offer the opportunity to reconstruct in a method different to that with which the community was established. Prefabricated architecture must take advantage of both new materials and those existing materials that can be used more intelligently and sustainably. Whilst this may be a sensible technological response, rebuilding using distinctly contemporary materials, technologies and methods might afford a more positive and rewarding approach to generating new communities that have been damaged both physically and psychologically.

Such objectives are deliberately broad and should not be mistaken for solutions to what is a complex problem shaped not only by the nature and scale of the disaster itself, but by the location, geographical make-up, economy, politics and society upon which it is inflicted. Rather, what these starting points offer is a basis for rethinking how prefabricated disaster relief responses might be approached.

I have argued that for at least the last two hundred years, prefabrication in some form has been thought of as a judicious building methodology, but that in some instances its uptake meets with resistance, or at best with some degree of begrudging acceptance simply because the method makes sense. It is not the contention of this paper that a move away from the prefabricated module in favour of a component-based architecture is the panacea to the global requirement for appropriate disaster relief buildings, or indeed any buildings. And of course, crisis conditions vary across the type of disaster and across first and third world conditions; their intricacies cannot be neatly summarised or assumed.

It is my contention, however, that when attempting to create meaningful places and spaces that people want to occupy, design matters. And if architectural delight – that which engages us with our built surroundings – can be activated through prefabrication in something as fundamental, crucial and deeply complex as emergency housing, then the potential for the future of prefabrication in our suburbs could be significant.

REFERENCES

- 1:1 Architects. (2009). "House Re-Growth Pod." Retrieved 6 August 2011, from http://web.me.com/raskil1/re-Growth_Pod/Home.html.
- Alexander, C. (2002). *The nature of order : an essay on the art of building and the nature of the universe*. Berkeley, Calif., Center for Environmental Structure.
- Anonymous. (2011). "My city is levelled . . ." Retrieved 8 September 2011, from <http://www.quakestories.govt.nz/>.
- Aquilino, M. J., Ed. (2011). *Beyond shelter: architecture for crisis*. New York, Metropolis.
- Cavanagh, T. (1997). "Balloon Houses: The Original Aspects of Conventional Wood-Frame Construction Re-Examined." *Journal of Architectural Education* (1984-) **51**(1): 5-15.
- CERA (2011). Draft Recovery Strategy for Greater Christchurch, Canterbury Earthquake Recovery Authority (CERA).
- CERA (2011). Draft Recovery Strategy for Greater Christchurch: A Summary Document, Canterbury Earthquake Recovery Authority (CERA).
- Chi, L. (2007). "Translations Between Design Research and Scholarship." *Journal of Architectural Education* **61**(1): 7-10.
- ChristChurch Cathedral New Zealand. (2011). "Cardboard Cathedral." Retrieved 22 September 2011, from <http://www.christchurchcathedral.co.nz/>.
- De Grazia, V. (2005). *Irresistible empire : America's advance through twentieth-century Europe*. Cambridge, Mass., Belknap Press of Harvard University Press.
- Epstein Jones, D. (2010). *Fast, Cheap and In Control*. Re.BUILDing: 98th Association of Collegiate Schools of Architecture Annual Meeting, New Orleans, Louisiana, The ACSA Press.
- Evans, J., Ed. (1980). *The lamp of beauty : writings on art*. Landmarks in art history. Oxford, Phaidon.
- Farrelly, E. (2011). *Victims need art like a hole in the head*. Sydney Morning Herald, 22 September 2011: 13.
- Gibson, A. (2011). "Plans for emergency houses unveiled." *New Zealand Herald* 21 April 2011. Retrieved 8 August 2011, from http://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=10720684.
- Giedion, S. (1967). *Space, time and architecture: the growth of a new tradition*. Cambridge, Harvard University Press.
- Glanville, R. (2009). "A (Cybernetic) Musing: Design and Cybernetics." *Cybernetics and Human Knowing* **16**(3-4): 175-186.
- Kieran, S. and J. Timberlake. (2007). "Future Worlds: Urgent Reflections on the Design of Practice." Retrieved 20 April 2011, from http://www.kierantimberlake.com/research/future_worlds_1.html#.
- Lynn, G. (2008). *Greg Lynn FORM*. New York, Rizzoli.
- Miyake, R., I. Luna and L. A. Gould, Eds. (2009). *Shigeru Ban: Paper in Architecture*. New York, Rizzoli.
- New Zealand Department of Building and Housing (2011). Request for Proposal: Portable Dwellings. New Zealand Department of Building and Housing. Wellington.
- Pask, G. (1976). *Conversation theory: applications in education and epistemology*. Amsterdam, Elsevier.
- The Press staff writer. (2011). "'Cardboard' cathedral revealed: Japanese architect's temporary Anglican home." Retrieved 6 August 2011, from <http://www.stuff.co.nz/the-press/news/christchurch-earthquake-2011/5366777/Cardboard-cathedral-revealed#comments>.
- Vitruvius, P., I. D. Rowland, M. Dewar and T. N. Howe (1999). *Vitruvius : ten books of architecture*. New York, Cambridge University Press.

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