

POD Building
Global Knowledge.
Local Materials

Annie Spinster

POD Building

a Print on Demand building system using global knowledge and local materials

This system is aimed at anybody needing to produce new buildings of any type, anywhere in the world. It aims to be highly flexible and adaptable to local needs and resources, while drawing on a common worldwide wealth of expertise and experience. All of the technologies involved in this system are already in existence, although they are generally at quite a young stage of development.

The first part of this document is a brief overview of how the POD Building system works. The second part contains further information about the main components of the system as well as the themes and inspirations behind the concept.

PART 1

The POD Building system

Ingredients:

- a globally accessible user-built library of virtual buildings
- numerous locally situated rapid manufacturing centres
- locally plentiful materials

How it fits together:

Materials

Locally available materials such as wood pulp / biomass pulp, recycled plastics and paper, sand, earth or stone based composites. Wherever practical, recycled materials would be chosen over newly extracted resources. There would be some trade of materials between localities.

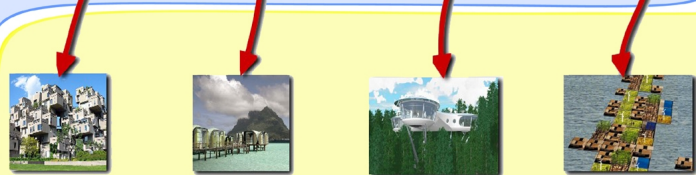


library

Publicly accessible database of virtual buildings, designed using **Building Information Modelling** processes. The core content of this database is available as an Open Content resource: anybody can create and upload a design and virtual buildings on the database can be downloaded, added to and adapted. A process of continuous peer review through ratings, product reviews and online discussion ensures quality. People from all over the world can share knowledge about what buildings work well with different climates, terrains and materials. Not everything on the database is necessarily free – the same technology and communication channels can be used for private enterprise, alongside the open content.

Rapid Manufacturing Centres

Locally situated, ideally built together with recycling facilities. Building models are sent here from the library and the parts are "printed out" close to where they are needed, using local materials. The Rapid Manufacturing technology should itself be modular, so that it can be adapted to use a wide range of locally available materials – anything from sand-based aggregates to recycled plastics. Local communities could install whatever "printing modules" were appropriate to the materials they had available.



Print On Demand Buildings

Can be used to build modular social housing complexes, expandable family homes, social spaces, industrial and retail spaces, emergency shelters ...

Components of POD Building

The Library

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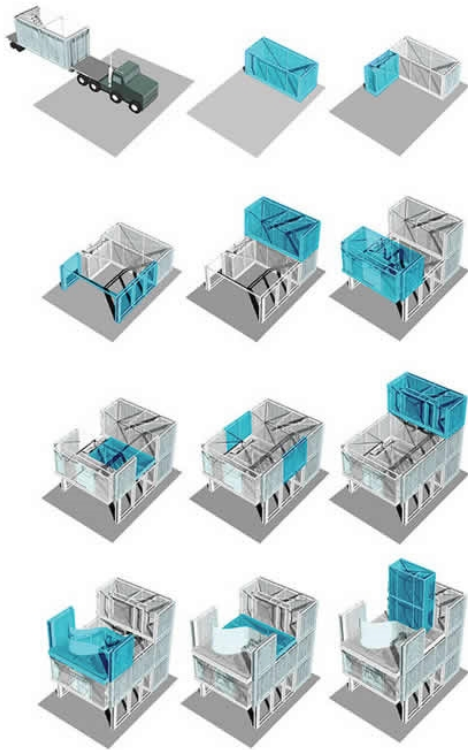
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Advantages of POD Building

- Pooling of expertise – helping everybody find building solutions for their local conditions.
- Massive reduction in transportation of materials.
- Uses recycled materials wherever practical.
- Technological flexibility – the same machinery can be used to print a huge range of buildings
- Design flexibility – designs can be adapted for individual and local needs, e.g. modular housing, built in disability aids, incorporation of locally crafted elements (wooden floor, stone fireplace)
- End-of-life – Modular building means that parts can be moved around and re-used in an existing build. Parts at the end of their life can be fed straight back into the rapid manufacturing units for recycling.
- Rapid emergency response – in the case of a natural disaster, nearby rapid manufacturing centres can be turned over to printing emergency shelters – cheap, temporary dwellings that can be produced fast using a minimum of materials.

Example: Kieran Timberlake - Cellophane House



"Cellophane House was drawn in three dimensions with building information modeling (BIM) software called Revit. This 3D solid, or parametric model, forms the basis for design, development, fabrication and assembly of the house. Parametric modeling is what made simultaneous off-site fabrication of this project possible. Without the geometric and dimensional certainty afforded by the closure of the parametric model - each dimension is accurate within 1/32 of an inch - parts could not be assembled in advance to the required tolerances. Therefore, dimensional discrepancies are reconciled in the model, instead of on the construction site."

(<http://blog.kierantimberlake.com/field-trip-40>)

Open Content = Global Knowledge

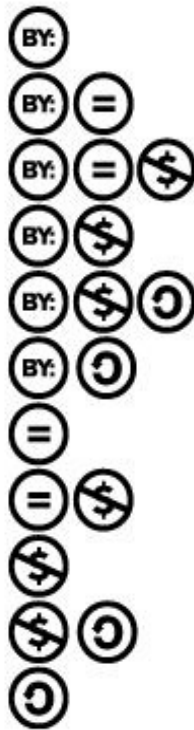
"Open content, a neologism coined by analogy with "open source", describes any kind of creative work published in a format that explicitly allows copying and modifying of its information by anyone, not exclusively by a closed organization, firm or individual. The largest open content project is Wikipedia."
(http://en.wikipedia.org/wiki/Open_content)

The majority of buildings in the database are released under an Open Content license which enables people from around the world to test, adapt and improve the designs and to contribute the wisdom of their experience to a growing, global knowledge base. This way of working enables people in desperate housing need to find suitable designs for their local circumstances, without having to pay for an architect or designer.

Of course designers and architects need to make a living as well. The Creative Commons open content licenses, or something similar, would allow the designer to release different designs with different combinations of rights reserved. For instance, a designer could release a basic design for free as a charitable project, but charge for custom variations on that design. They could also choose whether or not to allow others to charge for variations they make to the original design.



Open Content – Creative Commons Licenses

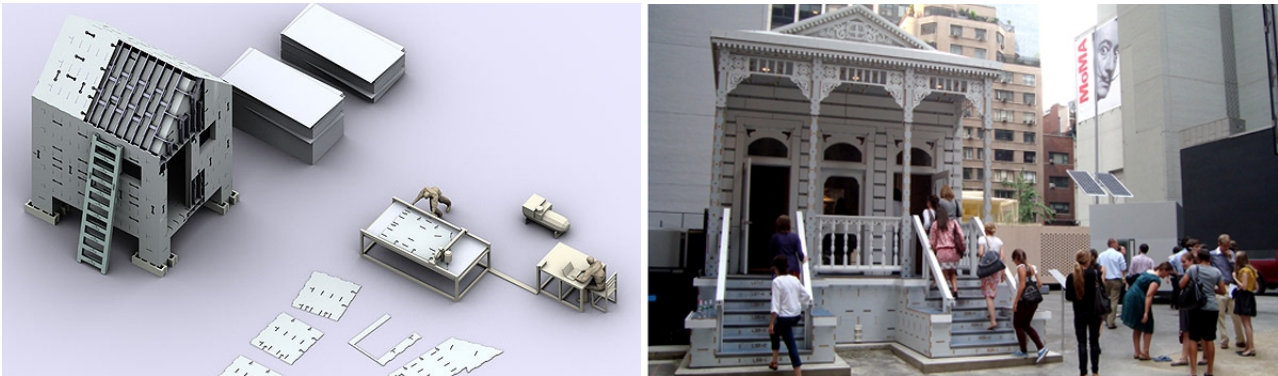


"Too often the debate over creative control tends to the extremes. At one pole is a vision of total control – a world in which every last use of a work is regulated and in which "all rights reserved" [and then some] is the norm. At the other end is a vision of anarchy – a world in which creators enjoy a wide range of freedom but are left vulnerable to exploitation. Balance, compromise, and moderation – once the driving forces of a copyright system that valued innovation and protection equally – have become endangered species.

Creative Commons is working to revive them. We use private rights to create public goods: creative works set free for certain uses. Like the free software and open-source movements, our ends are cooperative and community-minded, but our means are voluntary and libertarian. We work to offer creators a best-of-both-worlds way to protect their works while encouraging certain uses of them – to declare "some rights reserved."

[<http://wiki.creativecommons.org/History>]

Rapid Manufacturing Example: MIT Digitally Fabricated House



"The design is a digital translation of the New Orleans' style Shotgun House, complete with an ornamental front façade and a porch elevated off the ground on piers to allow flood-waters to rise and fall beneath the house. Every component of the house, from the structural members to the frieze ornamentation, was first digitally modeled and then CNC fabricated from plywood and plastic for a precise interlocking assembly."

quick facts

- *Entirely friction fit - no nails, screws or mechanical fasteners*
- *Composed of over 5,000 unique parts all fabricated on 2 CNC machines in 3 weeks*
- *21 days for assembly by 3 people*

(<http://design.mit.edu/projects#>)

Rapid Manufacturing Research - Freeform Construction

Dr Rupert Soar, Rapid Manufacturing Research Group, Loughborough University



"Freeform Construction is about 'printing' buildings, as if you were printing this page. It's about combining the whole design, construction and maintenance process into a seamless operation to produce structures and components which meet the challenges of our changing world and which will allow us to build on any terrain, against any backdrop, anywhere on the Earth, the Moon or Mars."

"For applications such as disaster relief and construction in arid environments, mobile Freeform Construction machines could be driven out to the site and may resemble a concrete boom

pump device. The key to these devices is in-situ resource utilisation (ISRU), which implies that the build material is sourced locally and loaded into the machine for building to begin. This means anything from mud to light aggregate material which can be crushed and mixed with a binder for deposition."

[<http://www.freeformconstruction.co.uk/>]

Print On Demand Books

Part of the inspiration for this project is Print On Demand book technology ...

"Put simply, print-on-demand (POD) means you can print just one book at a time. In the past, to keep unit prices down books had to be printed in their hundreds. This was not only expensive but it also meant that if the book sold only a few copies, publishers would be left with the headache of leftover stock."

(<http://www.antonyrowe.co.uk/>)

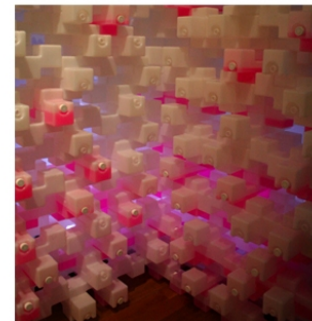


"Instead of going to the mall to buy your books, you'll just buy them on iTunes, then go to the nearest machine to Fairplay yourself a no-frills hard copy for a bucks or two. Barnes and Noble will be reduced to a coffee house and a vending machine: it's no coincidence they called this thing the Espresso."

(<http://blog.wired.com/gadgets/2007/06/book-vending-ma.html>)

Materials

A few examples of local and/or recycled materials which could be used for building ...



clockwise from top left: recycled woodchip, recycleable plastics, papercrete bricks, sand, Kengo Kuma's Waterblock building system (<http://www.kkaa.co.jp/E/main.htm>), earthbag and mud housing, mining earth for housing, recycled glass, recycled plastic chairs by Richard G Liddle and Sarah Blood (<http://www.inhabitat.com/2007/05/10/recycled-plastic-rd4-chair-handmade-by-codha-designs/>)

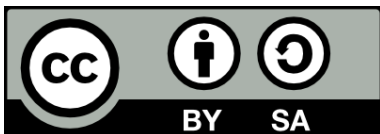
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cover illustration by Kimmi Baek

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