



### 05. Design

#### Design Principles

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##### *Shearing Layers of Change*

The origins of circularity have been traced back to theories which examined the natural systems to come up with ways of managing the man-made ones. The shearing layers concept is proof of that. The concept projects to buildings a notion that is otherwise inherent in natural systems: some processes have completely different life-cycles and may never feed into each other.

The concept of shearing layers of change, was originally developed by *Frank Duffy* and was later further elaborated by *Stewart Brand*. It conceptualizes a building as an assemblage of a total of six layers: *Site, Structure, Skin, Services, Space, and Stuff*. Both Duffy and Brand argued that these layers have different life-cycles: unless the Site is compromised by extreme natural phenomena like flooding, or earthquakes, it can have the longest life-span of all six layers. A building's Structure also has a very long life-span: in some cases, it can last up to 200 years, or more. However, this is highly unlikely for a building's façade (Skin) or air conditioning system (Services). Even less so for a building's internal layout (Space) and furniture (Stuff): these layers are usually subject to change at a higher rate. Take the window panes of a façade for example: these have a life span of approximately 25-30 years. After that time, they will require upgrading.

*In traditional building the shearing layers are all interdependent: mechanical installations for example are fixed on floors & ceilings, external walls and internal partitions. They are thus reliant on three different layers of Structure, Skin and Space. This makes it extremely difficult to maintain or replace in case of malfunctioning. Here lies one of the major challenges of circular design: decoupling the different layers so it becomes possible to repair, replace or adapt the layers that are without that affecting the others.*

The shearing layers principle is mainly related with Design for Disassembly.

##### *Open Building*

John Habraken's principle of open building was formulated in the 1960s and it became widely popular in Japan and The Netherlands. Its advocates argued that *the built environment is not rigid; instead, it is an artefact that is never finished*. In a similar rationale to the shearing layers, they focused only on the interdependency of the structural layer, to the infill systems for facades, inner walls and installations. Think how often a building's space plan can change: internal partitions and mechanical installations are usually the first layers that will be affected during a renovation.



## Circularity for Educators

They then distinguished between what they called the “*base*” *building and the “fit-out” level*. The structural building base is designed for longevity and is versatile to accommodate different uses. The infill on the other hand is conceptualized as a layer in constant transformation and therefore is required to respond to changing user needs much quicker. This way, the building’s life span could be extended to up to 150 years.

However, open building is not merely a technical concept, but also a social one. Habraken thought that architecture had internalized design decisions and that the role of occupants had been undermined. *The principle of open building restores responsibility to the building’s users: they would have to take over caring for it after the work of professionals was concluded. Furthermore, it seeks to establish a novel status of ownership as well: whereas the structure can be public, the infills can be product of co-creation processes between the building’s users and the home-owners. This in turn fosters community engagement and a sense of belonging and gratification, while also allowing people to regulate their expenses to tailor-made, affordable solutions. From a market perspective, open building pushes the building product sector to limit competition and increase product compatibility.*

The open building principle is thus mainly related with *Design for Adaptability*.