OpenStructures ruler
version 1.5

Element size

10mm 20 40 80 120 160 200 240 280 320 360 400 440 480 520 560

OpenStructures
Can we design hardware like how we design software?

In the current sustainability debate, we find ourselves confronted with diminishing resources on the one hand and an upcoming energy crisis and an unresolved garbage problem on the other. It is time to rethink our production, consumption and deconstruction processes.

The OpenStructures project initiates a new standard for sustainable and democratic design that, based on the principles of open-source software, facilitates the re-use of objects, parts and components and allows us to build things together.

The OpenStructures project
Concept / Context

Concept

Thomas Lommée has established a research project on what he calls 'open modularity.'
The project is an ongoing experiment that aims to find out what happens if people design objects according to a shared modular grid, a common open standard that stimulates the exchange of parts, components, experiences and ideas and aspires to build things together. It initiates a kind of collaborative LEGO to which everybody can contribute.

The purpose of this experiment is to investigate what the opportunities and limitations of such an open modular system are and under which conditions it will prove to be most efficient and favorable.

The ultimate goal is to initiate a universal, collaborative puzzle that allows the broadest range of people – from craftsmen to multinationals – to design, build and exchange the broadest range of modular components, resulting in a more flexible and scalable built environment.

An open modular system has the potential to generate flexible and dynamic puzzle structures rather than uniform modular entities. It will generate objects that have the ability to evolve and integrate old, new, cheap, expensive, original, bootlegged, manufactured and crafted components over time.
It has the potential to introduce variety within modularity, hereby not only stimulating re-use cycles of various parts and components but also enabling collaborative (and thus exponential) innovation within hardware construction.

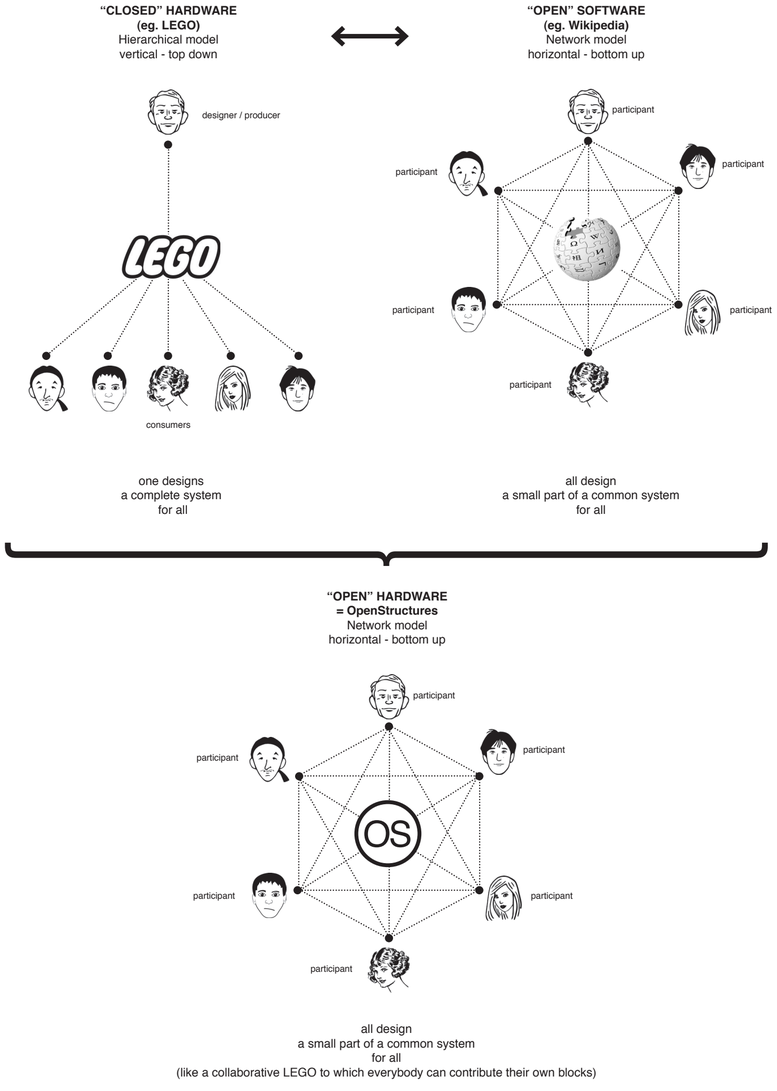
Context

The concept of modularity is nothing new: nature itself has proven that in complex systems, modular designs are the ones that survive. About 500 million years ago, single-celled organisms were able to advance into multi-celled ones that offered far superior characteristics, and therefore, were able to spur evolution.
As human beings, with trillions of modules (cells) per person, we are modular from head to toe and experience the benefits of modularity every single day. Modular cell structures enable us to scale and grow, simply by adding new modules (cells) that interact with existing ones, using standard interfaces.
They have the ability to rapidly adapt to their environments. By adding, subtracting, or modifying cells, incremental design changes could be more quickly tried and either adopted or rejected.
And finally, they enjoy the benefits of fault tolerance. With cell redundancy, individual cells can fail without degrading the system, other cells carry on while repairs are made. *(source: Neil Rasmussen, Suzanne Niles, Modular Systems: The Evolution of Reliability)*

But also in man-made structures, modularity is a known phenomenon. In an attempt to streamline efficiency and enhance structural flexibility, architects and designers have cranked out countless proposals for modular structures in the past. Nevertheless, we find ourselves today with an abundance of closed, incompatible modular systems that often generate impersonal uniform structures and a stockpile of fairly useless modular pieces after deconstruction.
So, if we want to improve the concept of modularity, we need to shift from hierarchical design processes, where one system imposes different standards than another one, to a more open standard.
In order to facilitate compatibility and enhance flexibility, we need to synchronize current dimensional frameworks and define one universal standard.

Within the realm of digital creation, we have already witnessed the emergence of such open architectures. These digital constructions are no longer invented and designed by one person or entity, but rather take shape through the minds and contributions of all its peers. Global collaborative efforts, like Wikipedia, are challenging and outperforming the individual achievements of some of our brightest, leaving us with no other choice than to acknowledge the limits of our individual projects and participate in larger collective processes.

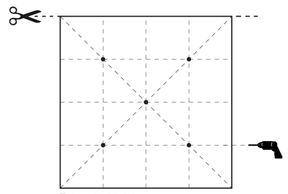
We need to distill a kind of physical 'html', a three-dimensional open-source code from our built environment that will enable us to build our hardware in the way that we are currently constructing our software.
These universal dimensional guidelines envision closed-loop systems, where old components feed into new frameworks, thus creating an endless variety of hybrid structures. The resulting 'open' structures, ranging from simple cabinets to multistory buildings, will then be truly scalable, flexible and diverse.

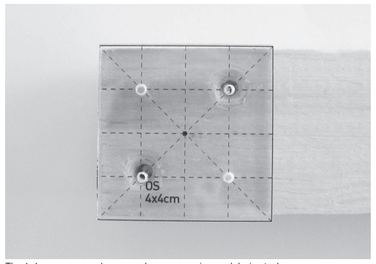


The OpenStructures toolbox
OS grid, website and guidelines

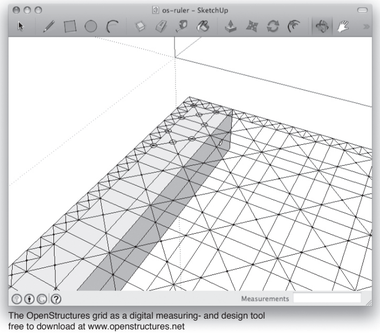
Tools for sharing

a. The OS grid
In order to be compatible, all OpenStructures designs / components need to be designed from the same geometrical grid. This grid is freely accessible on the OpenStructures website and is either used as analogue as a ruler or digitally as a 3D file, ready to be integrated into 3D software. The OS grid is built up out of 4x4cm squares. The borders of these squares mark the cutting lines, its diagonals mark the assembly points. The OS grid is the centerpiece of the whole OS system. It's the common metrical tool that is shared among all participants, which allows them to design interchangeable parts, components and structures independently from each other.
(for more info go to http://www.openstructures.net/pages/9#deel2c)


The 4x4cm square
as the basic unit of the OS system



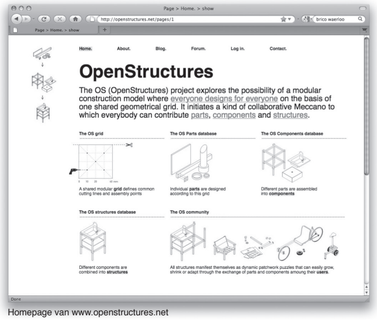
The 4x4cm square used as an analogue measuring- and design tool



The OpenStructures grid as a digital measuring- and design tool
free to download at www.openstructures.net

B. The OS website
The OS website *www.openstructures.net* is the digital marketplace for all parts, components and structures that were created by applying the OS grid. It serves as the central OS database and manifests itself as a global sharing point for the whole OS community.
All component designs can be up- or downloaded in order to be discussed, reviewed, ranked, copy/pasted and traded among its users. This vivid exchange of components will allow the parent structures to adapt, expand or shrink according to current needs and also stimulates continuous upgrades over time through a phased interchange of components.

Through online forums, open-source 3D software (SketchUp) and participatory production techniques (like laser cutting or 3D printing) the customer now has all the tools he or she needs to get truly involved in the design process.



Homepage van www.openstructures.net

C. The OS design guidelines
OpenStructures are dynamic puzzles by nature. In order to facilitate their design processes several design guidelines have been developed. These are rules of thumb that need to be considered while designing any part or component.

1. Always favor *assembly techniques* that allow deconstruction without damage or loss in order to facilitate the re-use of components.

2. Always position *assembly points* according to the grid, and choose, whenever possible, *dimensions* that are derived from the OS grid in order to maximize universal compatibility.

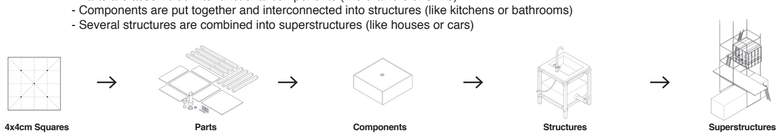
3. Always favor *100% synthetic or biological recycable materials* in order to support infinite material cycles.

The OpenStructures anatomy
From Part to Superstructure

Structural build-up

The structural build-up of an open structure follows the modular build-up of our own human body.

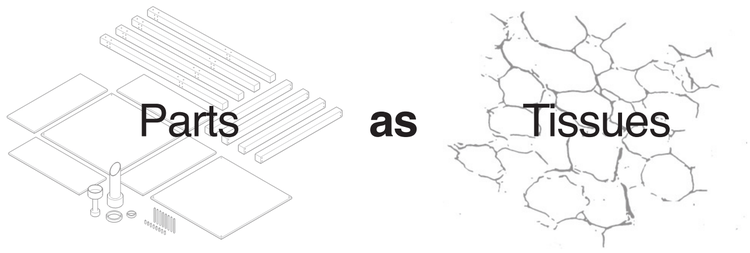
Namely:
- 4 4cm squares generate parts (like panels or beams)
- Parts are assembled into functional components (like drawers or sinks)
- Components are put together and interconnected into structures (like kitchens or bathrooms)
- Several structures are combined into superstructures (like houses or cars)



Just as …
- biological cells generate tissues (like muscle tissue)
- an assembly of tissues forms a functional organ (like a stomach)
- collaborating organs form a system (like the digestive system)
- a set of complementary systems form an organism (like a human being)

The 4 4cm square can be understood as the basic building block of the OS system. It is the central metrical unit that is shared among all OS designers which allows them to design compatible OS components independently from each other.

This is analogous to a biological cell, which is considered the structural and functional unit of all known living organisms. It is the smallest unit of an organism that is classified as living and is often called the building brick of life.

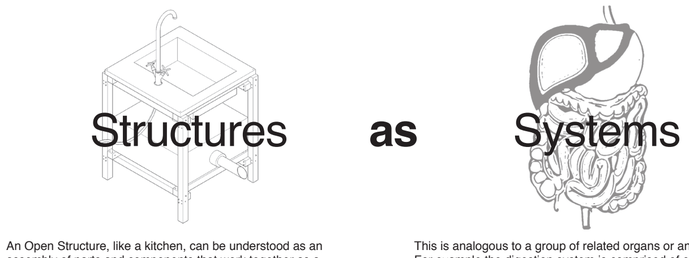


An Open Part, like a panel or beam, can be understood as a specific configuration of 4×4cm squares, resulting in various building blocks that are all generated within the OS dimensional framework. They have no function on their own but become functional in combination with other parts.

This is analogous to a tissue, a cellular organizational level which intermediates between cells and a complete organism. Hence, a tissue is an ensemble of cells, not necessarily identical, but from the same origin, that together carry out a specific function.

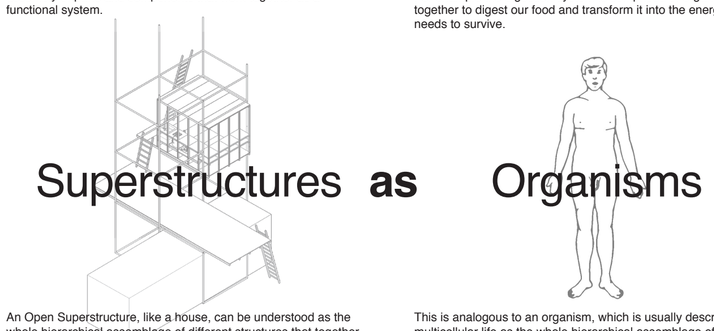
An Open Component, like a drawer or a sink, can be understood as several Open Parts that are assembled into functional, self-sustaining entities.

This is analogous to an organ, which is formed by the functional grouping together of multiple tissues.



An Open Structure, like a kitchen, can be understood as an assembly of parts and components that work together as a functional system.

This is analogous to a group of related organs or an organ system. For example the digestion system is comprised of organs that work together to digest our food and transform it into the energy our body needs to survive.



An Open Superstructure, like a house, can be understood as the whole hierarchical assemblage of different structures that together function as a stable whole.

This is analogous to an organism, which is usually described in multicellular life as the whole hierarchical assemblage of systems (for example digestive or reproductive systems). These systems are themselves collections of organs, which are, in turn, collections of tissues, further made up of cells.

The OpenStructures 'Beta test'
Exhibition / Conclusion

Exhibition

The exhibition follows the story-line of the different structural scales, and furthermore, highlights a collaborative installation as a first 'beta-test' of the system.
Just like software that is reviewed before its launch, the model is tested in order to detect possible bugs and improve the overall system. The resulting structures not only reveal the limits of the system but also demonstrate various synergies that emerge between different components. As a whole it displays a vivid patchwork of various personalities, materials, inspirations and motivations.
Thomas Lommée has invited the following designers, craftsmen and enthusiastic autodidacts to collaborate on this project and design within the grid:

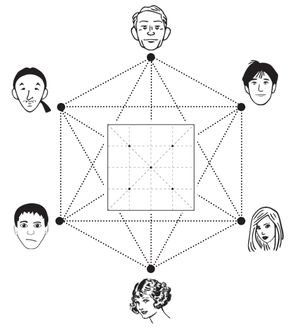
Laurens Bekemans	architect
Biogas-E vzw	bio-engineer / consultant
Nicolas Coeckelberghs	architect
Kar Yan Cheung	biologist / designer
Ken De Cooman	architect
Lise Foré	student
Christiane Hoegner	designer
Fabio Lorefice	intern / student
Lucas Maassen	designer
Jeroen Maes	craftsman
Karl Philips	artist
Thermopol nv	producer
Unfold	design studio
Jo Van Bostraeten	autodidact

Prior to the the exhibition, Thomas Lommée also collaborated with the KHLimburg and the Hogeschool Sint Lukas in Brussels. During several workshops, students were introduced to the topic and first tests took place. These processes will continue ext year through collaborations with Sint Lukas Brussels and the Design Academy Eindhoven.

Conclusion

Why not borrow from nature's blueprint and shape our built environment towards an organic, modular puzzle of objects that, from micro to macro, float within closed loops and infinite cycles.
Why not sync our existing logistical and architectural standards towards one universal standard that will generate an infinite diversity of blocks and combinations.
If we want to communicate we need to use the same vocabulary and grammar, if we want to exchange files, we need to work with the same formats. If we want to co-create our environment, we need to build with the same bricks.

If we shift from project to process, each design object becomes a prototype, an update, a new version.
Failure becomes opportunity and criticism becomes feedback, a perspective we need in order to further develop and improve our ideas. If we see our society as 'under construction', rather than 'accomplished', we will free up space for progress.



OpenStructures
Think inside the box

The OpenStructures project is a collaborative effort.

It was originally conceived by Thomas Lommée at the Institute without Boundaries and is now being further developed and tested by Lommée's design studio Intrastructures in association with various partners.

For more info:

www.openstructures.net
www.intrastructures.net

www.z33.be