OSArc (R)evolution: An Analog Understanding

Jonathon Meier
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Professor Keller Easterling

> *Linus Torvalds's style of development—release early and often, delegate everything you can, be open to the point of promiscuity—came as a surprise. No quiet, reverent cathedral-building here—rather, the Linux community seemed to resemble a great babbling bazaar of differing agendas and approaches...*[1]
> *-Eric S. Raymond, The Cathedral and the Bazaar*

The success of the open source software movement has continued since the early development of the Linux operating system in the 1990s. It has crossed into other genres of software–such as the Processing programming language–and has even reached into the corporate sphere with iPhone application development (Xcode) and Microsoft's open release of its Kinect software. Bypassing traditional economic and industrial hierarchies to harness maximum creative and technical potential, its proponents look to expand open source concepts into fields beyond software. Such fields include biotechnology, medical research, and architecture.[2]

To formally initiate a dialogue on open source architecture, Domus editor Joseph Grima asked Carlo Ratti (director of MIT's Senseable City Lab) to write an op-ed on the subject. Presented with the unwieldy task of articulating a new model for architectural design and production, Ratti delegated the project among friends and colleagues in art, architecture, and other related fields by forming an open source article on Wikipedia. A version of the wiki was captured in May of 2011 for publication in Domus, but the original wiki continues to be edited, developed, and updated freely by anyone choosing to contribute. The Senseable City Lab has deemed the wiki a "21st-century manifesto of sorts, which by definition is in permanent evolution."[3]

Because the open source structure is being lifted from the field of computer science, there is a tendency to assume technology as a given–a starting point–for understanding its manifestation in architecture. The majority of the initial wiki contributors have a lineage traceable to MIT's research labs, thus the temptation to define Open Source Architecture (OSArc) through its technological potentials is perhaps intensified. The manifesto is heavily laced with digital buzz words and concepts such as "parametric design tools," "3d printing technologies," "smart environments," and "sensor data" for "live inputs."[4] Its saturation with technological assumptions risks distraction–convoluting any explanation as to what OSArc actually is. In order to fully understand OSArc's potential, one must lift the veil of digital technology to expose its analog underpinnings. Technology may be the *how,* but what is the *what* ?

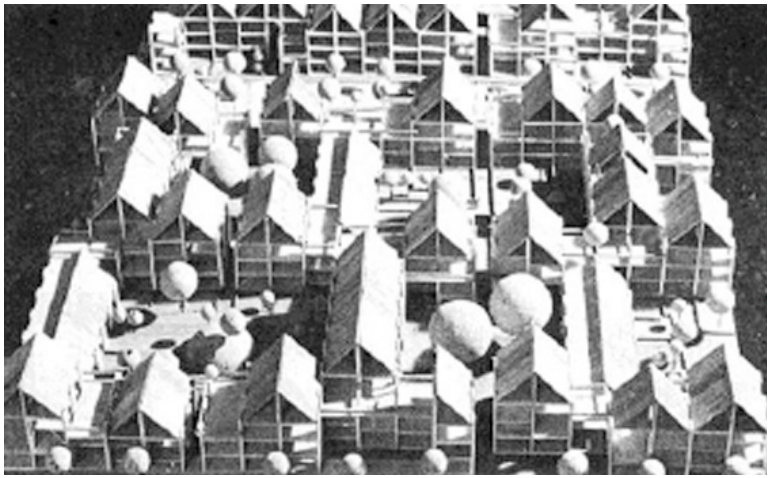
Decades before the term "open source" appeared, John Habraken–a future contributor to the OSArc manifesto–recognized the architect's inability to design for unexpected, variable conditions. In 1964, Habraken published *De Dragers en de Mensen. Amsterdam: Scheltema en Holkema* (*Supports: An Alternative to Mass Housing)* in response to the failures of post-war mass housing in Amsterdam. He blames these failures on the disconnect between architect and inhabitant, stating, "The conclusion must be that the return of the consultation and

involvement on the part of the users, in the most literal sense, must be accepted."[5]

For Habraken, it is not a question of an architect's intentions, but rather the architect's ability. Because an architect can only design based on his or her present knowledge, "his [sic] guess, in terms of dwelling, is no better than that of any layman." The architect may know more about buildings, and is surely more capable of realizing mass housing projects than any layman, but an architect is no more capable of understanding how an unknown user may choose to dwell. Any attempt at forethought cannot extend beyond one's own knowledge and will therefore be inadequate.[6]

> *All this symbolises the relationship between form givers and users. Does not the method we observe lead straight to the 'great creator' who determines all? Can we wonder that, being human, what he produces is a schematic reduction? Only it is regrettable that the model cannot remain the diagrammatic representation of the direction in which a living process has to grow, but that what we see on the model is literally to be built like that. It is not a diagram, but a design, it is the future of a town, reduced to an enormous architectural sketch, and all the unforeseen happenings which in time will be added to the buildings will be negations of the original vision.*[7]

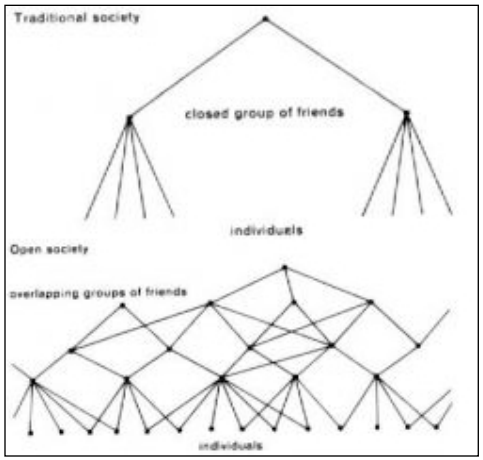
Habraken suggests that architects stop short of completion–that designs remain open-ended and flexible. His solution is a "support structure"–a system for dwellings which "can be built, altered, and taken down, independently of the others."[8] An aggregation of support structures would create a complex–yet flexible–framework for a town.



Molenvliet, 1977, Papendrecht, The Netherlands; John Habraken

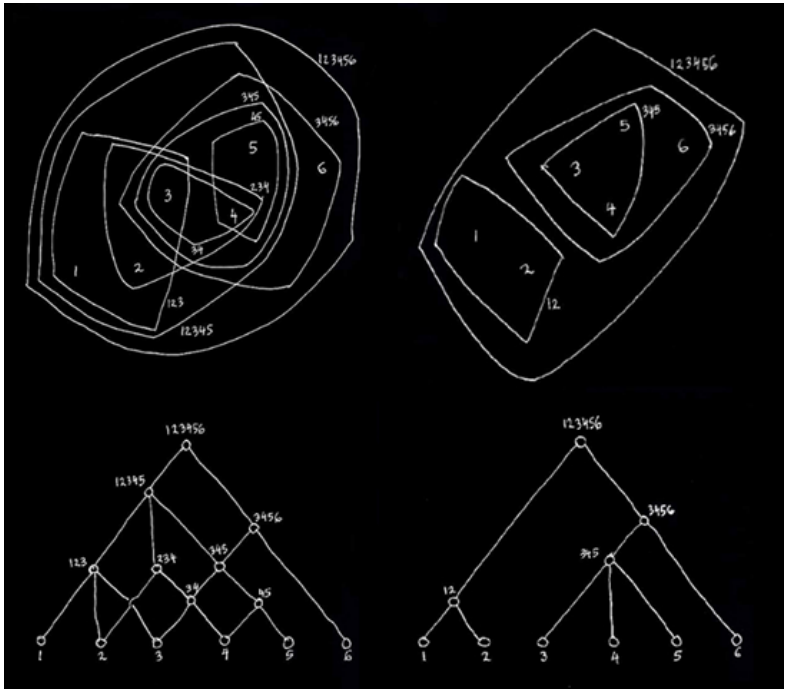
Almost concurrent with Habraken's *Supports* publication, Christopher Alexander introduced a similar design problem with an impossibly complex solution. In *A City is Not a Tree* (1965), Alexander describes a hypothetical urban condition in which a newsrack sits at the entrance of a drugstore. The drugstore is on a street corner next to a traffic light and crosswalk. While waiting for the traffic light to change, some people stand motionless, some look at or purchase a newspaper.

> *This effect makes the newsrack and the traffic light interactive; the newsrack, the newspapers on it, the money going from people's pockets to the dime slot, the people who stop at the light and read papers, the traffic light, the electric impulses which make the lights change, and the sidewalk which the people stand on form a system–they all work together.* [9]



Tree vs. Semilattice; Christopher Alexander

Alexander contrasts two types of abstract structures that can be related to the city: the semilattice and the tree. The aforementioned scenario is a semilattice. Its overlapping relationships allow for complexity and "multiplicity of aspect," and it is a "unit" of true urbanity.[10] A tree structure, however, includes no relational overlap between system components and therefore offers very limited complexity. The semilattice describes the endless interconnectivity between individual components of a city, whereas a tree describes a simplified, abstract and finite diagram.



Semilattice vs. Tree; Christopher Alexander

The problem that Alexander admits is that an individual cannot conceptualize a semilattice. A designer is only capable of thinking and organizing within the confines of a tree structure. At a certain point, the number of components and relationships considered by an individual must reach a limit.

> *...[T]rees are being proposed and built as cities...because designers, limited as they must be by the capacity of the mind to form intuitively accessible structures, cannot achieve the complexity of the semilattice in a single mental act.*[11]

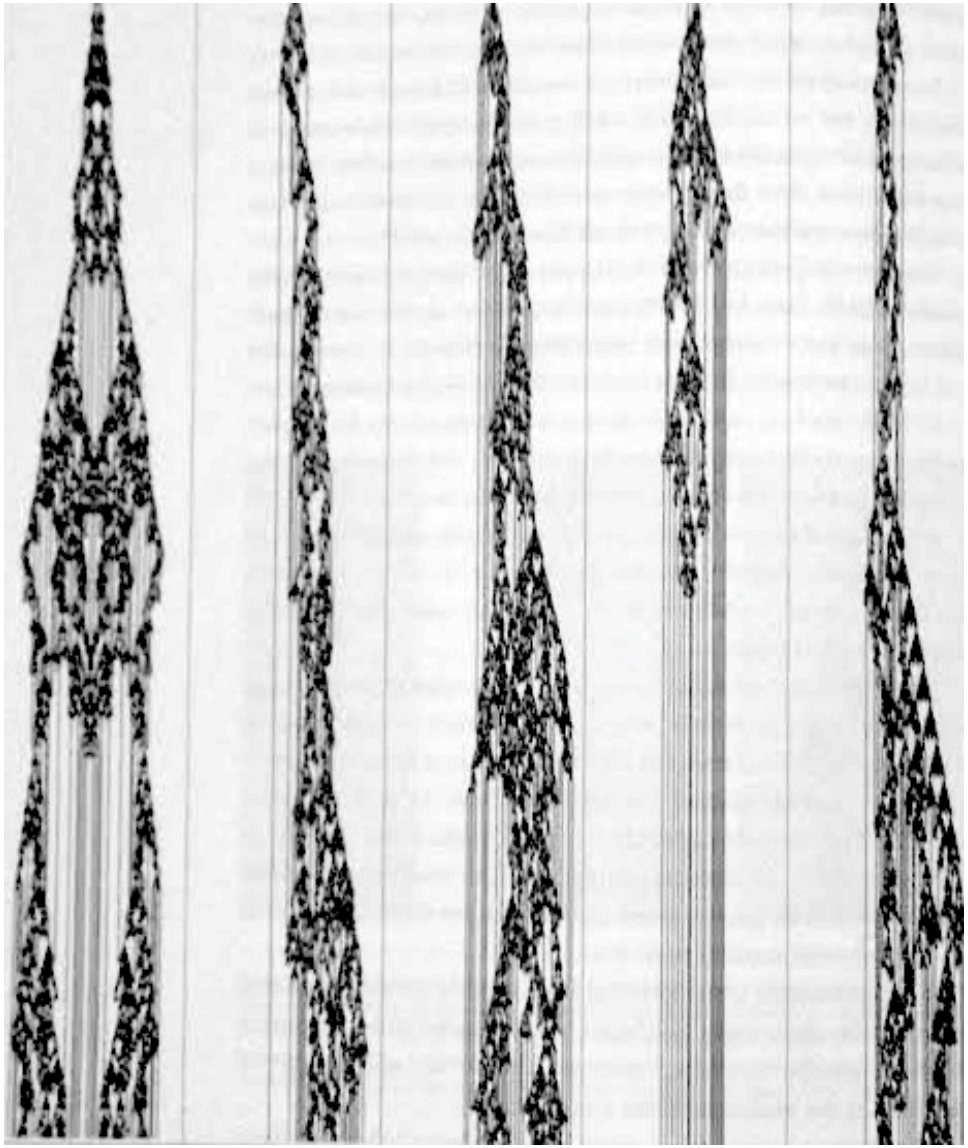
Several years later, Gregory Bateson re-conceptualized the mind problem into the terms of cybernetic systems. In *Steps to an Ecology of Mind* (1972), Bateson explains that every individual mind must be thought of as only a sub-system of a greater mind. A mind is always part of a system outside of itself and consists of both animate and inanimate objects. Each system of minds is part of another system, thus establishing an infinite combination and increasing scale of minds–none of which can be separated from one another, and all of which can be subsumed under a single, all-encompassing Mind. [12]

> *The delimitation of an individual mind must always depend upon what phenomena we wish to understand or explain. Obviously there are lots of message path-ways outside the skin, and these and the messages which they carry must be included as part of the mental system whenever they are relevant.*[13]

In his book *Infotopia: How Many Minds Produce Knowledge* (2006)*,* legal scholar Cass Sunstein posed a broad question addressing the concerns of individual knowledge limitations: “Is there a way for all of us to know what each of us knows?” Here, Sunstein is referring to wiki and open source structures in an analog sense, both of which he defines as devices used to “aggregate dispersed information.” Avoiding the tendency to use the terms interchangeably under the blanket of collaboration, he notes the clear distinction between wiki and open source structures: “with open source software, there is no unitary or publicly available good that anyone can edit.”[14]

For example, any Wikipedia page exists as a single, “unitary” good that is shared among all users. If any single user edits the page, all users will then be subject to those edits. No individual has their own version of the page to manipulate and personalize. An open source structure, however, “provides a method by which decentralized bits of private knowledge and creativity can be elicited and used.”[15] A “unitary” good may be available to everyone, but all users have the option to edit and manipulate the good on their own terms. This good can then be redistributed to all users allowing a multiplicity of goods. The cycle of manipulation and redistribution continues ad infinitum.

The resulting complexity of these ever-expanding cycles may be described by Stephen Wolfram as being “computationally irreducible.” In *A New Kind of Science* (2002), Wolfram introduces the *principle of computational equivalence,* stating, “...almost any system whose



Irreducibility in the evolution of cellular automata, 2002; Stephen Wolfram

behavior is not obviously simple will exhibit universality and will perform sophisticated computations even with typical simple initial conditions."[16]

In the context of an open source structure, the irreducibility stems from the application of any user's free will upon any iteration of the product before it is redistributed. `There is thus a separation between the rules for any open source system and the system's "overall behavior associated with the irreducible amount of computational work needed to go from one [rule] to the other."[17] The release of a very simple open source product will yield unpredictable and increasingly complex results:

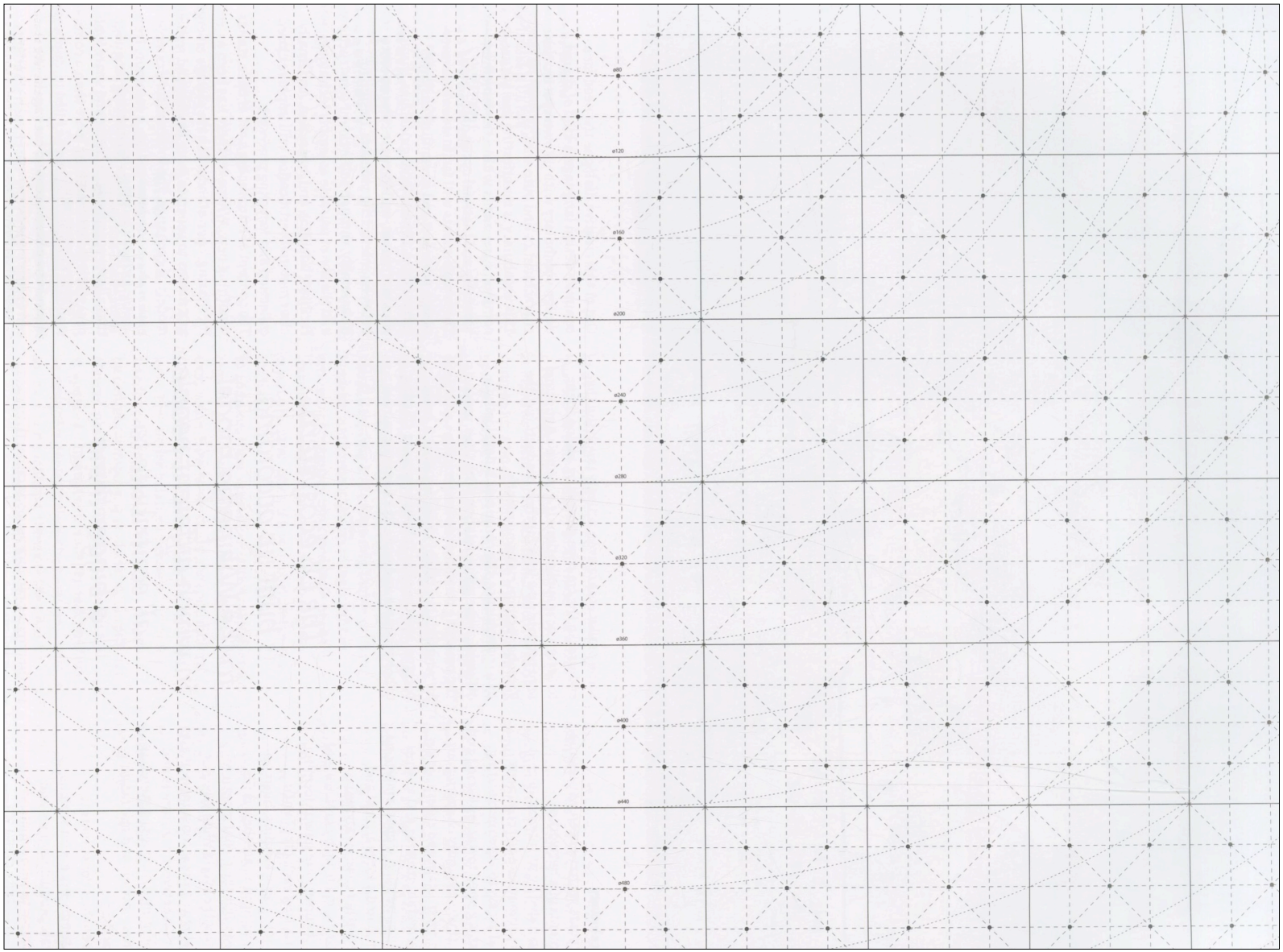
> *...[W]hat usually seems to happen is that we receive external input that leads to some train of thought which continues for a while, but then dies out until we get more input. And often the actual form of this train of thought is influenced by memory we have developed from inputs in the past–making it not necessarily repeatable even with exactly the same input.* [18]

In an open source structure, an initial input–assuming the participation of one or more users–will inevitably generate increasing multiplicity and variation. While the direction of this initial input or germ is entirely unpredictable, some trace of the input will always remain–however diluted or unrecognizable it may become. Its evolution is not forecast, but its lineage is traced.

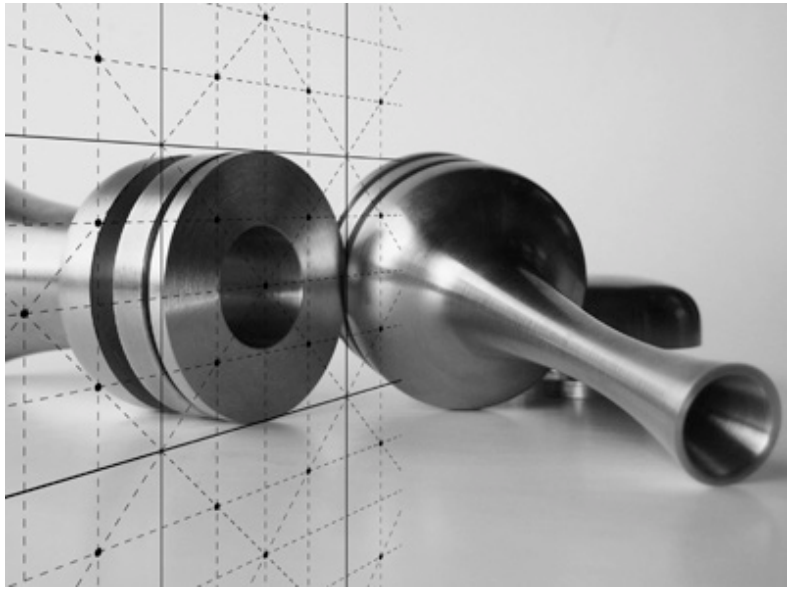
The germ can be conceived as a language. In open source software, it literally is. The language and its rules are used to communicate ideas and ensure compatibility between users. Compatibility allows ideas to bounce freely, pieces of which may be combined with other pieces to form entirely new ideas.

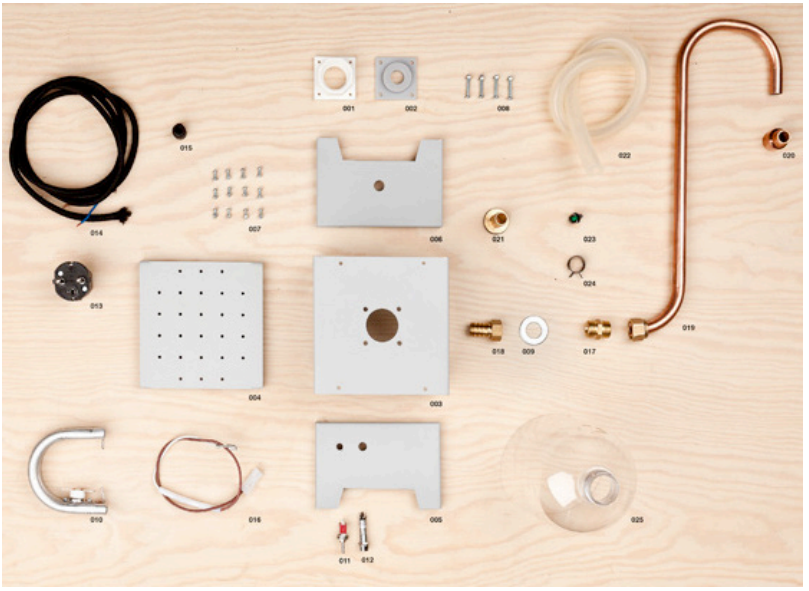
The OSArc manifesto looks toward Thomas Lommée's OpenStructures (OS) Project (2009-present) for a way in which compatibility can be ensured in a physical open source project. Created primarily for object-scaled design, the OpenStructures language is a modular grid shared by all users as a standard "to initiate a universal, collaborative puzzle." Anyone is free to use the grid to design products or product components, and everyone is encouraged to share their designs with others to achieve "a more flexible and scalable built environment."[19]

The OS grid is presented with a detailed set of instructions for use and a few general rules to ensure quality and flexibility (users are encouraged to design for disassembly and design with recyclable materials). While the grid seems quite simple–ripe for producing great diversity–a singular aesthetic emerges from the products. The aesthetic is undoubtedly the product's "traceable lineage," but it begs the question–is there a point in every open source structure at which *flexibility* yields to *compatibility*? Depending on the limits of the language and the rules given, the infinite potential for generations and evolutions may fit within an imperceptibly narrow set of parameters.



OS grid, 2009; Open Structures





modular components, 2009; OpenStructures

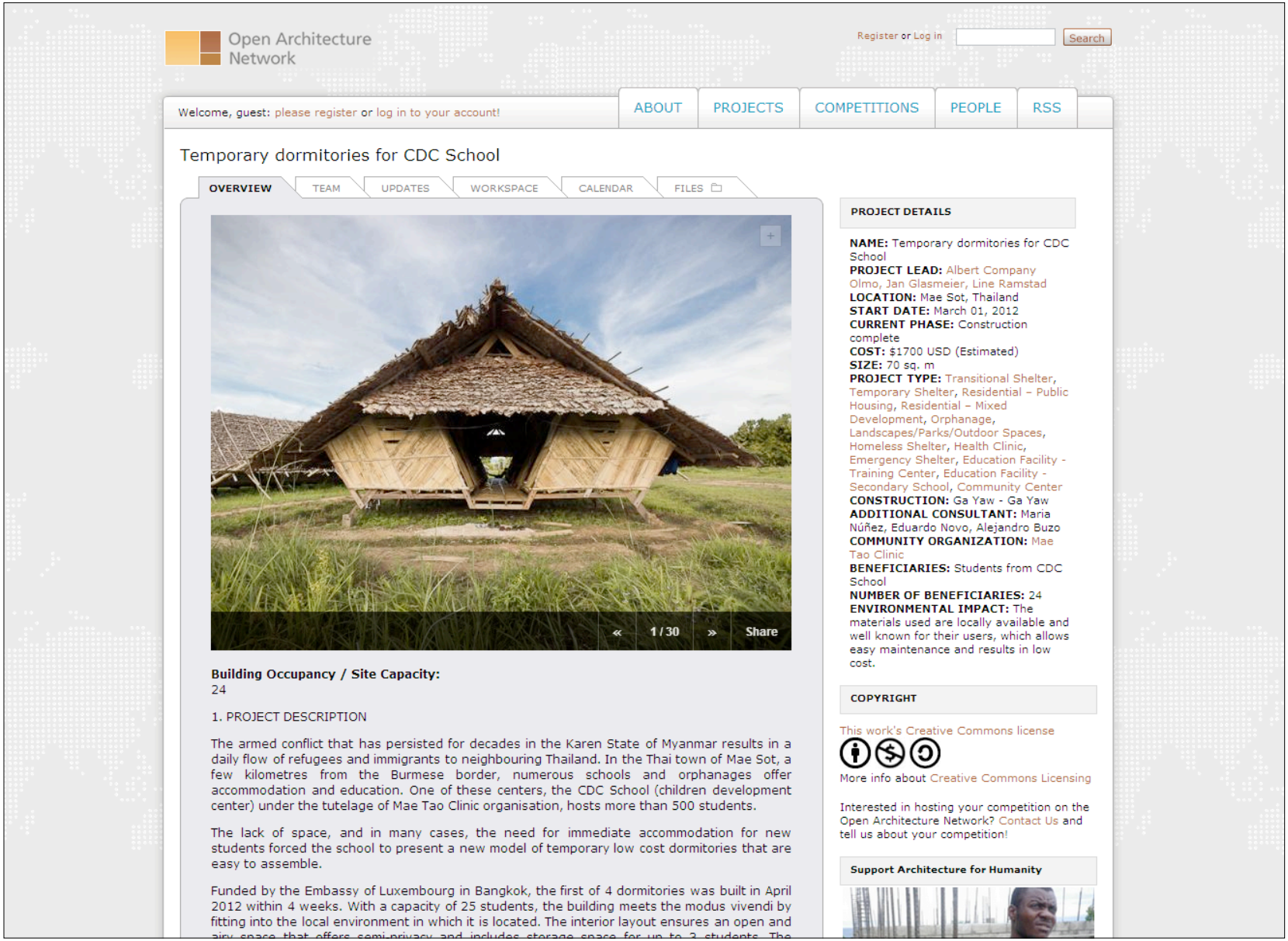
Increasing to an architectural scale, the OSArc manifesto mentions the Open Architecture Network as another example of an open source structure for the built environment. The network was founded in 2006 by Architecture for Humanity founder Cameron Sinclair. After winning the TED Prize, Sinclair launched the network as an extension of Architecture for Humanity, claiming one mission: "...to generate not one idea but the hundreds of thousands of design ideas needed to improve living conditions for all."[20]

The network serves as a platform upon which a system of minds may collaborate by openly sharing ideas and designs. Users can post projects and competitions, give and receive design critique, and design collaboratively with other users. It boasts the title of "first site to offer open source architectural plans and blueprints on the web,"[21] and, as of December 2013, the network holds more than 11,000 projects and has more than 43,000 users.

It operates on the boundary between a wiki and an open source structure–where the communication and design infrastructure is a wiki (many users co-designing a single, "unitary" project), but each designed product can multiply and mutate in the built environment in an open source structure. The designs on the website are available for all users to build, for wherever they choose to build them. While it is possible through this system that a single, generic building could potentially repeat itself across the planet, it is more likely that the designs would be altered based on localized conditions. According to the OSArc manifesto, "[m]ass customization replaces standardization as algorithms enable the generation of related but different species of design objects."[22] The manifesto continues by listing the computer softwares that enable such algorithms, but in the case of the Open Architecture Network, these "algorithms" are almost certainly analog–local climate and materials, skilled labor and funding availability, local governance and cultural traditions. With more than 11,000 projects and counting, a fear of a single project saturating the built environment would be unfounded.

Missing from the Open Architecture Network–if it is to be truly open source–is the reinsertion of a built project back into the system. While the platform permits and encourages a design-feedback loop, it affects only the "unitary" project. If, like open source software, a built project was redistributed in the network as a new project–including its localized alterations–the number of available projects would grow exponentially as "related but different species."

Established in 2011 by London-based Architecture OO:/, the WikiHouse project is a second open source structure at an architectural scale. Although a misnomer (there is no "unitary" project), WikiHouse functions more purely within an open source structure than does the Open Architecture Network. The creators describe WikiHouse as "an open source construction set. The aim is to allow anyone to design, download, and 'print' CNC-milled houses and components, which can be assembled with minimal formal skill or training."[23] The "language" in this open source structure is CNC-milled 18mm plywood, with design standards requiring specific dimensions for joints



Open Architecture Network platform, 2013

and structural spacing (ensuring compatibility). Like the Open Structures Project, a distinct aesthetic emerges from the initial germ.

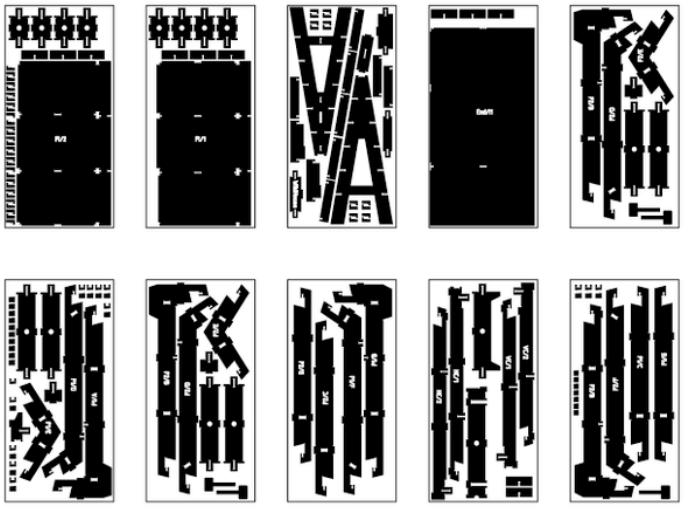
The WikiHouse creators stand by a John Maynard Keynes quote, “it is easier to ship recipes than cakes and biscuits.”[24] No single building is delivered to a site as a kit of parts to be assembled. Rather, the instructions are made available for an individual or group to alter, evolve, and share. Designers are encouraged to “be lazy like a fox”[25] and begin with other people’s solutions rather than attempting a design from scratch. Exploitation is encouraged.

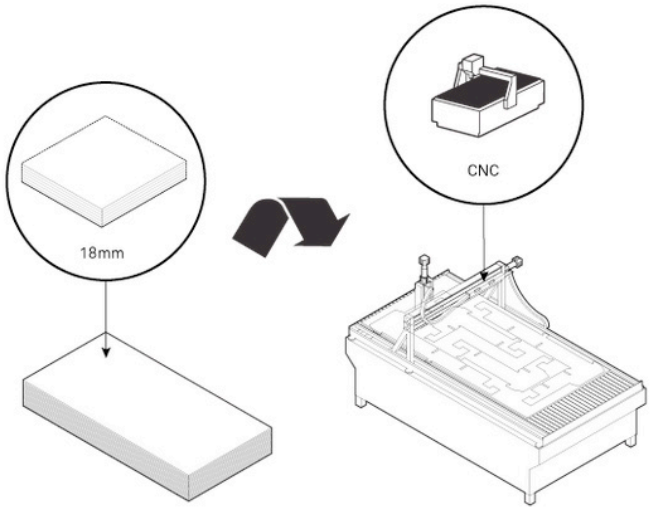
While open source proponents trumpet its universal accessibility, all open source structures depend on several assumptions about the users, which are integral to any potential success. The first assumption is that there *will be* users. Any open source structure requires the participation of–and access to–multiple minds. A platform with an initial germ is stagnant without users to begin the evolutionary cycles. At that point, the extent to which the germ evolves and mutates depends upon the number of users and the amount of energy each one is applying.

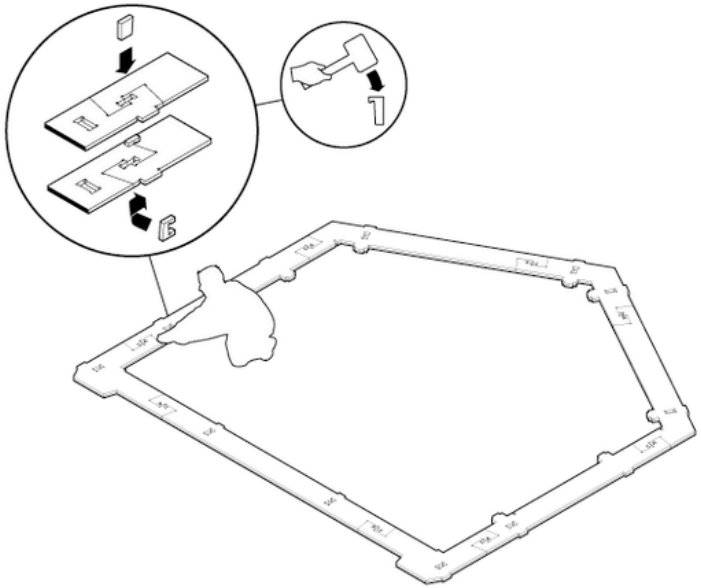
A second assumption is that users will be capable. The success of WikiHouse, for example, is dependent upon the number of users who can “cook” (there is a reason why people purchase “cakes and biscuits”). Though the WikiHouse design guidelines call for a streamlined assembly, an amount of construction knowledge and physical strength is assumed of any user–therefore limiting the extent of a project’s universality. An OSArc project may be an “aggregation of dispersed knowledge,” but the realization of a design is still dependent on individual (or local) knowledge. There is a minimum amount of knowledge required of any user in an open source project.

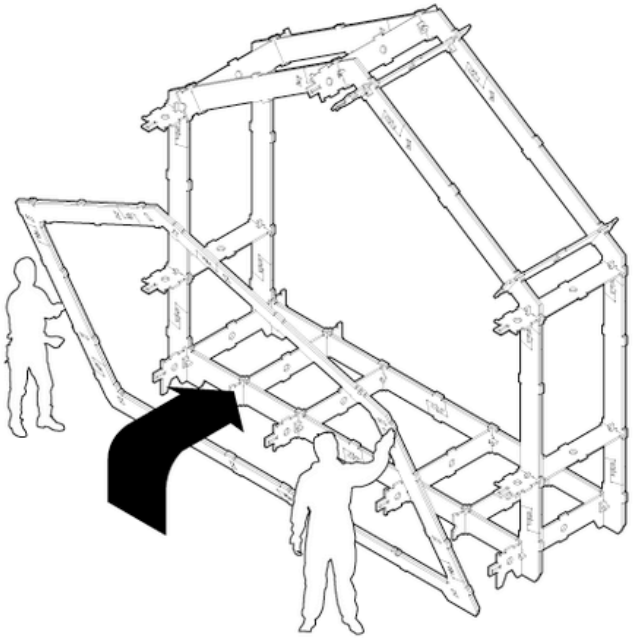
The third assumption is that users will have access to all necessary resources. The ideas that are shared, evolved, and mutated through the WikiHouse platform cannot materialize without access to 18mm sheets of plywood and a CNC mill. As compensation for a lack of resource provision, WikiHouse cut sheets include a tool with the parts for assembly (à la IKEA). The CNC cut sheets include a mallet–which can be used as a functioning tool, for those who find it easier to access a CNC mill than a mallet.

Any open source structure is fueled by an egalitarian exchange of information. For information to flow freely, traditional proprietary measures–such as copyright laws–must be circumvented. Many open source projects, including WikiHouse and the Open Architecture Network, use the Creative Commons (CC) license to permit free distribution on copyright products as long as credit is given to the author. Other licenses more explicitly prevent ideas from entering the marketplace. Often used for open source software, the General Public License (GPL) ensures that, “when you distribute the [independently authored] sections as part of a whole which is a work based on the Program, the distribution of the whole must be on the terms of this License.”[26] That is, under a GPL, no user can take another’s project and claim it exclusively

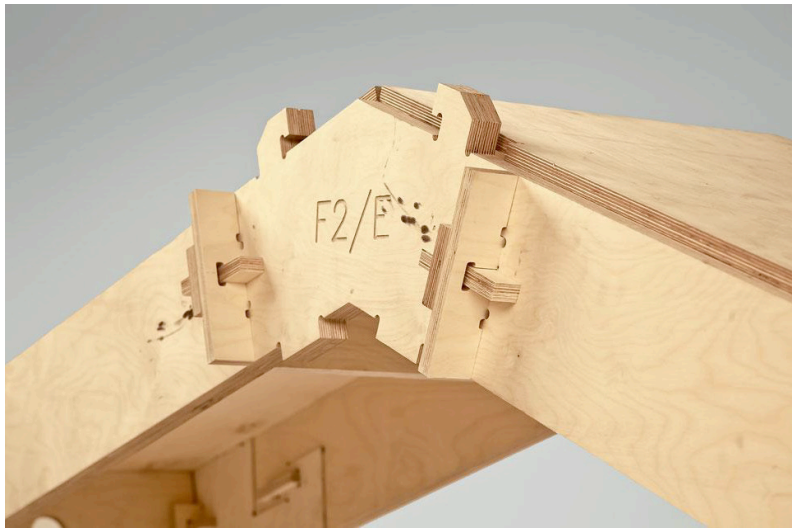








WikiHouse Assembly Instructions, 2011



WikiHouse Assembly

as their own.[27] Literally reversing the intended use of a traditional copyright, The CC and GPL are used to *prevent* the ownership of ideas.

In terms of open source *software*, professor and lawyer Yochai Benkler names three characteristics–independent of privacy prevention measures–that allow for non-market information production. The first of which is that personal computers are nearly ubiquitous in developed economies, which means that "the physical machinery can be put in service and deployed in response to any one of the diverse motivations individual human beings experience." The second characteristic is that the "raw materials" of an information economy are already owned by the public. That is, "existing information, knowledge, and culture" have no actual cost. The third is that the organization of open source software sharing platforms is "modular," thus individuals can be "diversely motivated" during production while still contributing new, useful information.[28]

The logic of Benkler's three characteristics applies to the idea-sharing platforms of OSArc, but the distinct difference between open source software and OSArc is the necessity to transform information into tangible, built things. Benkler also–like the OpenStructures and WikiHouse examples–assumes the necessary physical resources as a given. His logic explains how anyone who presently has the necessary resources may function in this non-market economy, but it avoids the essential fact that one must participate in the market economy in order to later avoid it.

OSArc relies even more heavily on access to capital than its software counterpart. Materials, tools, and fabrication equipment must be procured. It is this inconvenient truth that is OSArc's achilles heel. It is no law of physics or scientifically unproven belief that stands in the way of a purely open source architecture, rather it is the unavoidable economic and political setting in which it must operate.

Though its capitalism problem cannot be cured in the current state of affairs, it is being mitigated. Much in the same way a wiki accumulates distributed knowledge, crowd-funding platforms such as Kickstarter and Sponsume are breaking traditional hierarchies of capital access by accumulating distributed funds. These platforms place the power to finance projects into the hands of the masses. Rather than convincing a corporation to manufacture a design based on its estimated profitability in the marketplace, designers can convince individuals who can then contribute as much as they wish to help realize a project. Crowd-funding is a way of avoiding traditional access to capital, but it is a small bandage on a system that demands continuous funding. An OSArc system is iterative and infinite–therefore demanding constant funding if iterations are to be realized.

The iterative and infinite system introduces a strange characteristic of OSArc–that open source projects can be shockingly difficult to critique. They cannot fail, because to fail is to assume that a project has reached a final state or position, upon which it may be judged. Every version is a beta version. In such a system, it is futile to discuss that

which *is*, because that which *is* immediately thereafter becomes that which *was*. The present tense is conveniently irrelevant. It should not, however, be a problem that a newer and improved version is on its way. The system is incomplete because it is forever evolving, and evolution is largely seen as progress. To “release early and often” is to prevent an idle state.[29]

The cathedral sits in an idle state, to use Eric Raymond’s famous example. A Cathedral is unveiled in a pristine state after years of construction and will remain for centuries. A bazaar will evolve. A bazaar is mutating and flexible, combinatory and aggregate, parametric yet infinite, egalitarian and unpredictable. A bazaar is incomplete. It is not defined–but is accelerated–by technology. The Cathedral and the bazaar can coexist. One need not replace the other. But the bazaar offers much that the Cathedral cannot provide. It offers the potential to serve many more people, and it promises to address their diverse needs and desires. The bazaar may not be perfect today, but there will be a new bazaar tomorrow.

[1] Eric S. Raymond. 1999. The cathedral & the bazaar musings on Linux and open source by an accidental revolutionary. Beijing: O'Reilly. http://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=24619.

[2] Cass R. Sunstein. 2008. Infotopia: how many minds produce knowledge. New York; Oxford: Oxford University Press, 164

[3] Carlo Ratti, et al., “Open Source Architecture,” *MIT Senseable City Lab,* http://senseable.mit.edu/osarc/.

[4] Thomas Lomée. “The Esperanto of objects.” *Domus* 948 June (2011): 88-95.

[5] N. J. Habraken. 1972. Supports: an alternative to mass housing. New York: Praeger Publishers, 3, 31, 33, 59-60.

[6] Ibid.

[7] Ibid.

[8] Ibid.

[9] Christopher Alexander. 1965. “A City is not a Tree,” *Architectural Forum,* Vol. 122, No. 1 (April, 1965): 58-62 (Part 1); and Vol. 122, No. 2 (May 1965): 58-62 (Part II)

[10] Ibid.

[11] Ibid.

[12] Gregory Bateson. 1972. Steps to an ecology of mind. New York: Ballantine Books, 324-5.

[13] Ibid.

[14] Cass R. Sunstein. 2008. Infotopia: how many minds produce knowledge. New York; Oxford: Oxford University Press, 168, 177.

[15] Ibid.

[16] Stephen Wolfram. 2002. A new kind of science. Champaign, IL: Wolfram Media, 743, 751-3.

[17] Ibid.

[18] Ibid.

[19] Infrastructures. “OpenStructures,” Infrastructures, http://openstructures.net/pages/2#vraag-1c.

[20] Infrastructures. “OpenStructures,” Infrastructures, http://openarchitecturenetwork.org/about

[21] Ibid.

[22] Carlo Ratti, et al. “Open Source Architecture (OSArc)” *Domus* 948 June (2011): iv.

[23] WikiHouse Team. “WikiHouse,” http://www.wikihouse.cc/about.

[24] Ibid.

[25] Ibid.

[26] Cass R. Sunstein. 2008. Infotopia: how many minds produce knowledge. New York; Oxford: Oxford University Press, 153, 167

[27] Yochai Benkler. 2006. The wealth of networks: how social production transforms markets and freedom. New Haven: Yale University Press, 104-106

[28] Ibid.

[29] Eric S. Raymond. 1999. The cathedral & the bazaar musings on Linux and open source by an accidental revolutionary. Beijing: O'Reilly. http://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=24619.