ECOFRAMES
THE POWER OF LESS

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DESIGN & RESEARCH:
Eco-Urbanism - Community Design - Environmental Consulting

01. ECOFABRICA is a factory of environmental design, which utilises research-based design in a holistic way.

02. ECOFABRICA is always focused in the requirements of our clients and their communities and gradually open to the multidisciplinary consultants with whom we collaborate from the initial stage to the completion of each project . Working around the world, we use the cutting-edge communicational technologies to facilitate frequent and effective visual and graphic outcomes in each study or design project.

03. ECOFABRICA, through our experts, provide a systematic scope of services tailored to the specific requirements set forth by the demands of each sustainable design or study. Our services include spatial planning, master planning and urban design; environmental design consultancy; sustainable urban and building analysis; and eco-design schemes.

VISION:

01. INNOVATION THROUGH ECO-DESIGN
Ecofabrica leads design teams in the pursuit of place-specific, high-performance designs. Ecofabrica collaborative design approach starts with a thorough analysis of each site, programme and community, identifying social and environmental factors that will generate an eco-friendly overall design. Afterwards we process these key characteristics within broader research criteria for sustainable habitats; spatial flexibility; programmatic adaptability; weather-shed protection, energy production and distribution; employment of low-embodied energy and local materials; and outdoor/indoor environmental quality.

02. REPAIR - REUSE - RECYCLE
What we consider waste of one system becomes a nutritious value for another. Our built environment can be designed to have a low environmental impact by carefully dealing with the immediate physical context; climate and energy; and utilization of materials for new products or buildings.

03. RENEWABLE ENERGIES - SYNERGIES
Our planet thrives on the energy of current solar income. Therefore our built environment can utilise renewable energies in many forms -such as wind, water, geothermal and gravitational energy- by exploiting on these resources while supporting human development and a low-carbon environmental agenda.

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"Man is small, and, therefore, small is beautiful". E.F. Schumacher[1]

Space is a limited resource especially in cities. Architects are dealing with new facts such as speed and lightness. Thinking about the minimum appears as a manifesto of Elementarism against oversized architecture. Small design opens up unexpected trails of spatial production and provided new functional flexibility with spatial interoperability. Do more with less. The sculptor Richard Serra stated *"the biggest break in the history of sculpture in the twentieth century occurred when the pedestal was removed"*[2]. If we relate this statement in architecture, what happens when the foundation is removed? With less weight might it shrink? Can it become lighter and smaller? Minimum means not only smallness but also removing all what an architectural project might have as superfluous, redundant or unnecessary. Consequently the search of elementary living means to tackle with new functional and environmental factors. What do we should take into consideration during this design process? A research on compact design should above all identify potential obstacles; explore feasible space-frames; and then look at potential smart technologies applied in frame and skin. Compact architecture is about re-qualifying the sense of 'less' within the ordinary life. It is efficient in terms that it does more with less.

Image 1. Futuro House. It is a round, prefabricated house designed by Matti Suuronen, about 100 were built during the late 1960s and early 1970s. The distinctive flying saucer like shape and airplane hatch entrance has made the houses popular among collectors. The Futuro is composed of polyester plastic and fibreglass, measuring about 3 meters high and 8 meters in diameter. The Futuro house was a product of post-war Finland, reflecting the period's faith in technology, the conquering of Space, unprecedented economic growth and an increase in leisure time. The initial design was a ski cabin that would be *"quick to heat and easy to construct in rough terrain".* The end result was a universally transportable home that had the ability to be mass replicated and situated in almost any environment. Source: Internet (Video, *Futuro - A New Stance For Tomorrow* directed by Mika Taanila. Finland, 1998, 30 minutes, 35 mm film), accessed in 16 November 2007.

The Antithesis of Monuments

There are many standard examples of oversized architecture, for instance, the notion of monument.

[1] Schumacher, E.F., *Small is Beatiful: Study of Economics as if People Mattered. Part 1. The Modern World, A Question of Size.* Page 56. 1973, London, Blond and Briggs editors.
[2] Serra, Richard, *Serra, Richard*. Page 34. 2000, Boston, MIT Press

The classical dilemma between power and representation, we can find by analysing the film *'The Battleship Potemkin'*[3] by Sergei Mikhailovich Eisenstein. There is a significant gig where the establishment, represented by monumental machinery, attacks unarmed fishing boats and insurgents situated along the shoreline of the Black Sea. Dialectally the photography evokes the confrontation between heaviness and lightness, the dilemma between monuments versus pavilions.

Image 2. The Battleship Potemkin. Tsarist soldiers march down the *"Odessa Steps"* from the film 'The Battleship Potemkin', directed by Eisenstein (1925). Source: Internet, accessed in 16 November 2007.

If we historically study the spatial evolution of architecture, we can find out a gradual dematerialization of the space, from mass to film. Lightness and smallness constitute the main achievements. Nevertheless, there are still cases of 'grandiose' architecture, which provide unnecessary space without taking into account emergent needs and new technologies. Undoubtedly those generic typologies require a double check:
Type 1: The Railway Station. Initially conceived as massive container of coal-fuel emissions, this structure has been gradually reduced both in layout plan and section due to the use of alternative energy and the overlapping of new public transport systems. Nowadays railway stations are well-adapted to the urban and human scale. For instance, the initial giant hall has been replaced by compact deck within urban mixed-use blocks, with platforms climatically well-protected and electronic ticketing service.
Type 2: The Temples. The spaces for meditation use to be centres of political and religious control. In liberal societies based in individual rights, these institutions have a less leading role and their shapes are shrinking. What you find in a contemporary temple is a basic space-frame based, concentric rather than axial and surrounded by benches or the like. Only a common height is required.
Type 3: The Public Library. From the beginning of the nineteenth century, the access to library became more public but still kept a monumental character. For instance, the Public Library in Stockholm by Gunnar Asplund reveals a profound oligarchic language based in a pyramidal layout: the knowledge is not achievable for all. It still stores up mostly academic knowledge in packs so-called books. After a recent design entry competition this infrastructure will be upgraded to deal with new users that do not have time or enough interest just in books. So less acquisition of books implies less storage but more for social interactivity. Everything seems to shrink, become smaller.

Butterfly Versus Elephant-type Dwelling

Architecture consists of light or heavy spaces. For instance, pavilions perform like butterflies. Butterflies are lightweight animals with powerful wings. In terms of area, the wings are larger compared with their bodies. Butterflies quickly respond to the environment. Monuments perform like

[3] Based on the historical events the movie tells the story of a riot at the battleship Potemkin. What started as a protest strike when the crew was given rotten meat for dinner ended in a riot. The sailors raised the red flag and tried to ignite the revolution in their home port Odessa.

elephants. They are not defined as lightweight bodies. If the environment changes, they can also adapt but only slowly and after a long period. How might a butterfly-type house perform? It might have highly responsive skins with a great deal of transparency and thus react quickly to solar changes, daylight and temperature, by altering their properties. It also might have openings that vary according to air flows. Parts of its skin can capture energy and generate power or heat directly just as some butterflies employ the sun's radiant heat to warm them up. Instead of maintaining a constant body temperature, butterflies are *pokilothermic* organisms; it means theirs indoor temperatures vary with the surroundings.

Living systems in motion

Apart from sizing and load, the limits of architecture also flow between what is stationary and what is in motion. The ability to move, shrink, change or adapt are prerequisite for surviving. In the case of architecture in motion, there are new factors that are playing a significant role in its development: new data transmission; variable divisions in compact space; and flexible furniture and appliances. What might an elementary house be like? A house design for compact, light and flexible living could be one which during its occupation might be moved from one place to another or be changed in its shape or structure. Walls might fold; floors shift; staircases extend; lighting, colours and surface textures metamorphose. Parts of the house could leave the site and return, or the entire building could collapse, float, inflate up or simply transport to a different location. What are the main guidelines of this design? To design an efficient compact house, certain parameters have to be taken into consideration: location (site response); use of solar energy; space-frame; circulation (easy flows and access); weatherproofing skin; service spaces; and movable furniture.

Image 3. Mobile home.
Mobile home in Norman, Oklahoma, USA. Source: Suau collection, 2007.

The Compact House is a Pavilion

The main characteristics of a pavilion are threefold: lightness, compactness and transitoriness. It means the pavilion –like a compact house- is characterised by a space-frame in motion: a permanent

lightweight, agile and refillable framework. This chassis allows full flexibility in order to house variable uses and provide multiple assemblages and combinations.

Image 4. B. Keaton's master piece *One Week*, 1920.
It ingeniously shows what are the montage of mass prefabrication and the vulnerability of the *'kit home'*: Sense of placeless; anonymity of the dwellers; monochromatic repetition; and lack of appropriation. In fact, *One Week* is the story of seven days construction of a family house, with its decoration and finishes; also the opening and the loss. This film appears as a parody against standardized architecture, by exploring unexpected trails of spatial production and providing new spatial flexibility and customized interoperability. Source: Internet, Metro Picture Corporation's archives (nowadays Ren-Mar studios), 1920, accessed in 16 November 2007.

The Compact Living in Ten Points

1. Minimum Space

If we observe the traditional Tatami module, the main space is used as social space, private retreat and sleeping space simultaneously. It is a place with a changeable core and has a concept of flexibility within a permanent dwelling. Its shape is basically a huge thatched roof that creates the potential to be almost entirely open or closed. There are 2 kind of sliding panels: fusuma (opaque) and shoji (transparent) and is made by a lightweight timber frame and covered with paper film. By pushing, pulling or manipulating this separators or divisory surfaces, occupants freely arrange the house. In actual Tokyo, the dimensions of the capsule hotel are 0.8m times 0.8m times 2.0m each. It is the minimum space to sleep and if we need to take off our personal clothes, we should use a common fitting room like. Instead of leasing per nights or weeks, these capsules are leased per minutes.

2. Minimum Energy

Buildings have to be able to protect their occupants against climatic conditions. Clearly the most sophisticated control systems occur in latitudes with extreme climatic behaviour: rainfall versus rainless and warmth versus coldness. How can we deal with flows of solar energy and recycling/reused of building materials in compact houses? If we examine the spectrum of so-called sustainable or ecological architecture, we see a 'deep-eco' attitude in one hand and a 'high-tech' approach in the other hand. Both refer architecture in time but in very different ways. Smart

architecture means minimum use of energy and zero use of fossil one. It represents a flow-energy interface between dwellers and the surrounding.

3. Minimum Ecosystem

Any system is merely a combination of elements that interact with each other and with the surrounding. Referring to ecosystems, these elements always include living organisms, what they produce (i.e.: oxygen, food or waste) and the energy transfer that is required. The key point is that all bio-elements contained in the system are able to transfer energy each other somehow. Some buildings can react to sunlight with shutters or heat up with valve systems. Compact shelters should be able to react to changes by adaptation and connectivity between different housing systems.

4. Minimum Perimeter

In terms of manufacturing and cutting criteria, straight-angle surfaces like rectangles are figure that, by keeping the maximum of area, used the minimum of perimeter. Thus they minimise leftover parts. A remarkable example is IKEA.

5. Minimum Amount and Weight of Building Materials

Environmentally, how much materials should be used? The issue is to reduce the embodied energy of building materials. Building manufacturers have a strong cost incentive to reduce the amount of building materials used. Not only low-value material expenses are reduced in lighter or smaller components, but costs of distribution and storage are also saved. Light weighting has to be considered in the context of the entire life cycle of the building materials! It also means that a very light design solution may not be desirable if is not possible to utilise again, when strength and durability factors would become important.

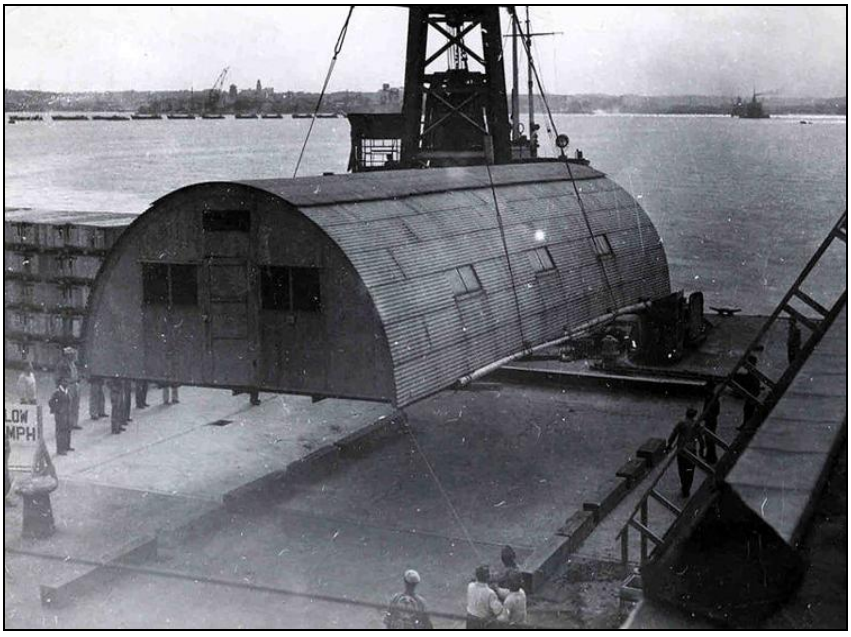

Image 6. Quonset hut

A Quonset hut being emplaced at the 598th Engineer Base Depot in Japan, post-WWII. A Quonset hut is a lightweight prefabricated structure of corrugated steel having a semicircular cross section. The design was based on the Nissen hut developed by the British during World War I. The name comes from their site of first manufacture, Quonset Point, at the Davisville Naval Construction Battalion Centre in Davisville (a village located within the town of North Kingstown, Rhode Island). In 1941 the United States Navy needed an all-purpose, lightweight building that could be shipped anywhere and assembled without skilled labour. The original design was a 16 by 36 ft (5 by 11 m) structure framed with steel members with an 8 ft (2.4 m) radius. The sides were corrugated steel sheets. The two ends were covered with plywood, which had doors and windows. The interior was insulated and had pressed wood lining and a wood floor. The building could be placed on concrete, on pilings, or directly on the ground with a wood floor. The flexible interior space was open, allowing for use as barracks, latrines, offices, medical and dental offices, isolation wards, housing, and bakeries. Between 150000 and 170000 Quonset huts were manufactured during WWII. Many are still standing throughout the United States, primarily used for commercial buildings. Source: Internet, http://www.quonsethuts.org, accessed in 16 November 2007.

6. Minimum Volume for Living

Compactness has to learn from the packaging industry in the sense to provide an efficient fabrication of forms. Like a basic wrapping, it will be performed similar to a sleeping bag or a matchbox. It implies that will have the minimum dimensions to contain/store dwellers and objects. At least an opening must be introduced to allow access and ventilation; communication and visual contact and avoid, for instance, suffocation or claustrophobia.

The ability to move, change or adapt are prerequisite for life. In the case of compact housing living, there are some facts that might play a significant role in its potential development: A. the expanding functions of data transmission; B. variable divisions of interior space; and C. flexible furniture.

So, what might non-standard compact house be like? It might be an elastic space-frame designed for light and flexible use, which allows moving from one place to another or be changed in its volume. Just like a pack! It means that walls might fold over; floors shift; staircases extend; lighting, colours and surface textures metamorphose. Parts of the house could leave the site and return, or the entire building could collapse, float, inflate up or simply transport to a different location. Hence, the idea of the elementary home does not lie in the sense of rootness but transit.

Image 7. Railway City, Europan 8. Runner-up award 2007 in Hamar, Norway. Mobile housing system consisting of two units: a based-space frame for living and a green house container performing as thermal buffer. Source: Suau archive.

7. Minimum Assemblage

PALLET HOUSING SYSTEM (PHS) is a design patent and constitute an ecological design response by recycling timber. It shows innovative and agile uses offered by shipping boards applied to compact dwellings that can be easily assembled or disassembled. The connectors are metal bins and packaging stripes (metal or plastics) and they come from the packaging industry. Neither cranes nor scaffolds are used to connect walls with floors or roofs. There are two types: Cubic and A-frame dwellings. Both models are designed to provide alternatives for those who have low-income or not enough capital to enter to the standard housing market. So, PALLET HOUSING SYSTEM has expandable and contractible spaces and varying types of green/smart building materials with the intention of providing a simple form adaptable to different climates. In terms of space distribution, the houses have a central kitchen/bath core with sleeping compartments and an expandable social area. Units can be grouped to form larger social entities and common spaces. Or multiple units can be connected to create a larger space for a family. It rests lightly on the land as an alternative life in remote places, slums or emergent urban sprawl.

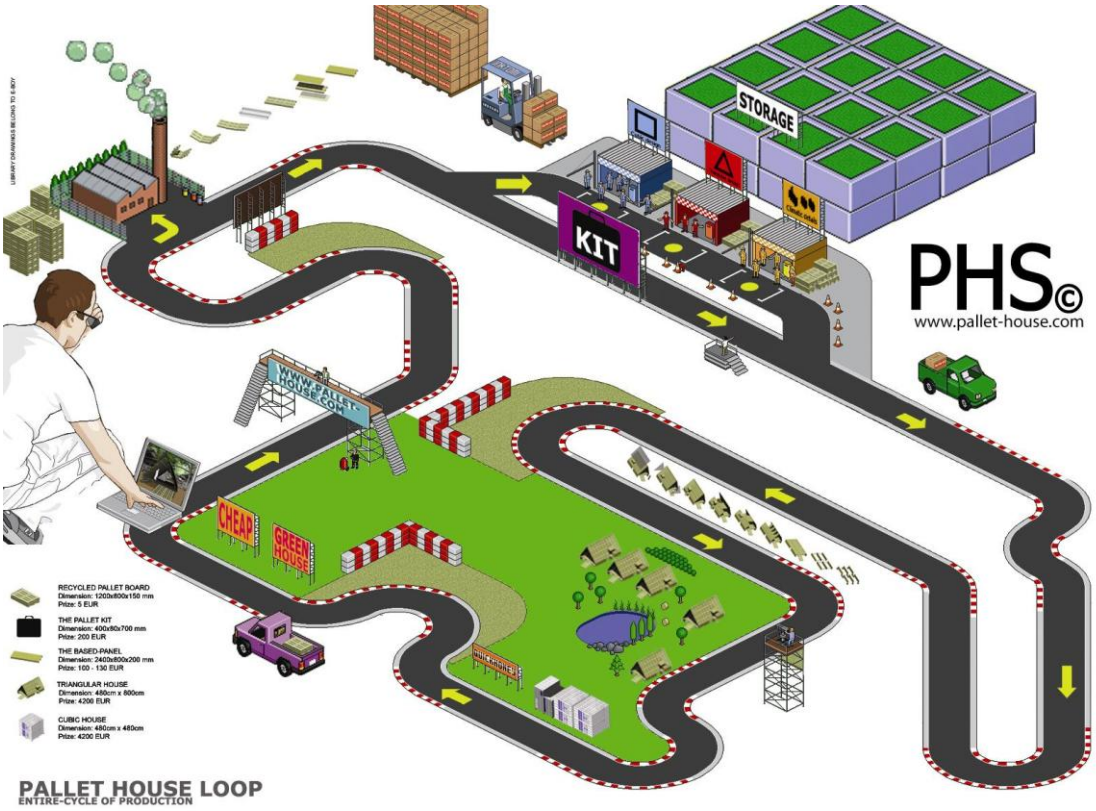

Image 8. PHS (Pallet Housing System) Design by Dr. Cristian Suau.
It is a system using recycled pallet boards as low-tech timber-frame systems to create units that are easy to transport and assemble. The modular system is based on the dimensions of a Euro-pallet, 120 x 80 cm. This postdoctoral research was carried out at NTNU, Norway and ETSAB, Barcelona (2004-2006).
The system is being developed under the premise of using junk as well as recycled materials in order to construct inexpensive, environmentally friendly and residential compact space. Suau Ibáñez, Cristian, 'Pallet Housing System - PHS©: A potential wood-frame design applicable in different contexts', in PLEA - Passive and Low Energy Architecture: Built environments and environmental buildings, Eindhoven: Technische Universiteit Eindhoven, 2004. Source: Suau collection, 2005 and Internet, http://www.flexiblehousing.org, , accessed in 16 November 2007.

8. Minimum Floor Area

(…) Once when I was six years old I saw a magnificent picture in a book, called True Stories from Nature, about the primeval forest. It was a picture of a boa constrictor in the act of swallowing an animal. Here is a copy of the drawing. (…) I showed my masterpiece to the grown-ups, and asked them whether the drawing frightened them. But they answered: "Frighten? Why should any one be frightened by a hat?" My drawing was not a picture of a hat. It was a picture of a boa constrictor digesting an elephant. But since the grown-ups were not able to understand it, I made another drawing: I drew the inside of a boa constrictor, so that the grown-ups could see it clearly.
De Saint-Exupery, Antoine. *'The Little Prince',* Chapter One.

In *The Little Prince*'s One Chapter, illustrations show gradually the transformation of a bendy pipeline –the boa-, which changes according to what is 'digesting'. Further mutations are the result of what the boa's intestine can house in its cavity.

The floor area has to deal with the store capacity of any space and it is a plan analysis. To calculate its capacity, we simply enter the width and depth of its *'room'* and the unit of measure and the resulting floor area of the room will be calculated in several different units of measure.

A similar case can be found in the shape of an Igloo, an anthropomorphic shelter constructed from blocks of snow, generally in the form of a dome, easy to build and follow the human body. The outcome is a circle in plan and a semi-circle in section. Similar compact layouts can be found in the interior of a kiosk, automobile, balloon or pram. In addition, another case can be found by observing

the Saddam Hussein's hideout: a minimum underground cavity built along the Tigris embankment which consists of a resting space, a ventilation pipeline and one way out. In both cases, the logic of surviving becomes imperative either by erecting or carving a basic hollow room.

Image 9. Tyre Igloo, design patent by Dr. Cristian Suau
This prototype follows the morphology of an igloo. Instead of using blocks of snow, TYRE IGLOO, is structured by disused tyres strapped plastic or metal connectors. This postdoctoral research was carried out at NTNU, Norway and ETSAB, Barcelona (2004-2006). Source: Suau archive

9. Minimum of Permanence

A minimum of permanence means taking a place with you. Also it means a place easy-to-carry, portable and collapsible. The best samples are found in light structures like tents, umbrellas or parasols. The need for flexibility in nomadic lifestyle coupled with a much more open relationship with the environment, results a dwelling system that is adaptable, open to invention and more integrated with nature. Unfortunately, we perceived vernacular dwellings quite undersigned and unchanging. However, these simple forms have a remarkable versatility and flexibility, both in response to changing climatic conditions and potential for development. This is clear in the case of tents and mobile home for nomads. Tent consists of a single living space and generally made from textile, its envelopes can bear extreme weathers and move across long distances successfully. It can be described as a lightweight dwelling where the cover can be detached from a collapsible, supporting structure, and both can be transported. It is tensile structure.

10. Minimum Manifesto

A fascination with the art of compact architecture is not new. Groups, such as Archigram in London and Utopie in Paris, were exploring portability in Europe in the 1960's—a trend that peaked around 1968 with the coincidence of the Utopie's Structures Gonflables exhibit in Paris and the premiere of the Cushicle project by Archigram in Milan. Together, these groups set a precedent for a new avant-garde, a forum for innovation and criticism outside the boundaries of traditional art and architecture. Though the history of elemental architecture has been very well documented, little effort has been made to asses a variety more recent housing work as a coherent whole. In the 1990's, the work of artists like Jorge Pardo, Vito Acconci, Glen Seator and Rachel Whiteread incorporated architectural ideas into discussions of contemporary art. Compact structures are anti-architecture, a manifestation of the culture of speed that contradicts the domesticity and permanency so implicit in most architecture.

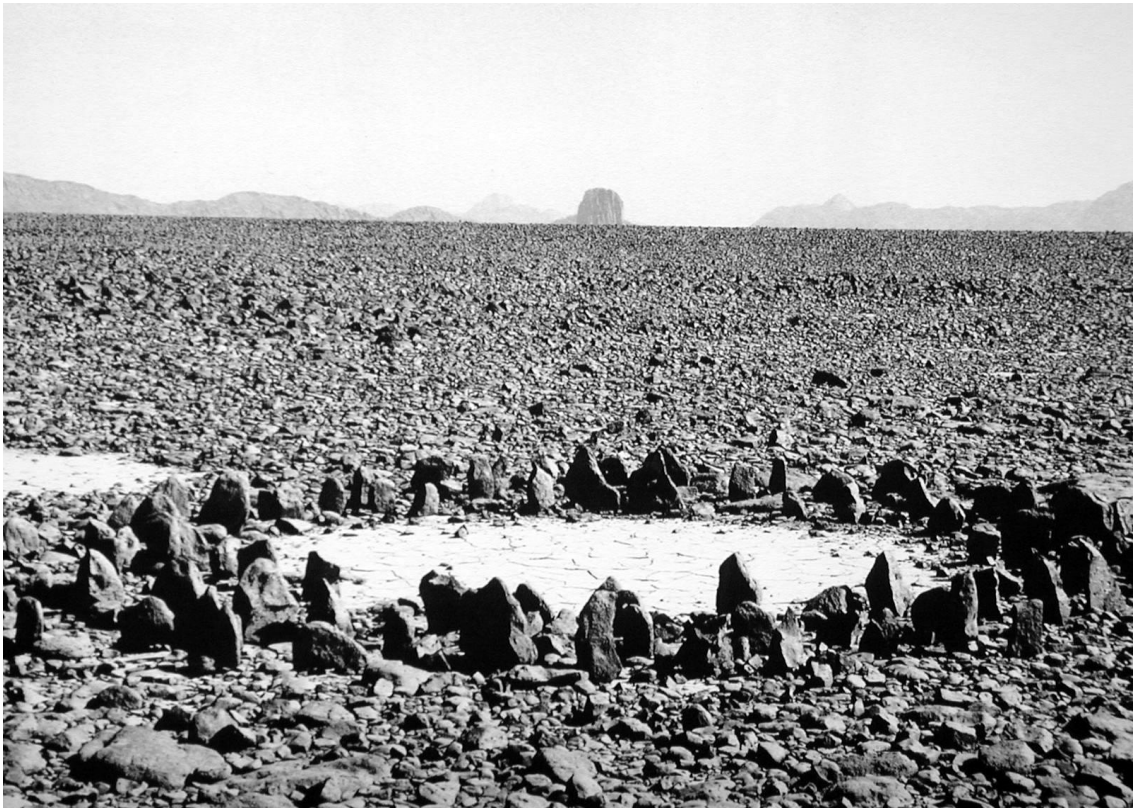

Image 10. Richard Long's Installation.
It is made by Richard Long called *Where the walk meets the place Sahara*, 1988. Source: Richard Long. Courtesy, Haunch of Venison (December 2007).