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MINIMALNA PRAVILA IGRE: Okoljsko primerna zasnova in nizkotehnološka izdelava v birojih

MINIMUM GAME PLANS Eco-Design and Low-Tech Fabrication in Studios

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IZVLEČEK

V raziskavi s primerjalnimi metodami poučevanja in projektiranja kritično preučujemo načela nizkotehnološke izdelave in visokega dizajna, ki so od leta 2004 predmet mednarodnih delavnic v Španiji, Sloveniji, Čilu in Združenem kraljestvu pod vodstvom avtorja tega prispevka. Raziskava se osredotoča na sisteme poučevanja in učenja o okoljsko primernih zasnovah izdelkov , ki se izvajajo v nekaterih projektivnih birojih in manjših delavnicah. Od leta 2008 pripravljam intenzivne tritedenske projektivne delavnice kot del dodiplomskega študija v sklopu t. i. vertikalnega projektiranja, ki poteka na valižanski šoli za arhitekturo (Welsh School of Architecture (WSA)) v Cardiffu.

Izbrani primeri pokažejo, da sodelujoči študentje in tutorji lahko hitro razvijejo pomembne okoljske in konstrukcijske veščine, kot so prostorska vsestranskost, zavedanje o okolju in življenjskem krogu ter doseganje znanja preko prakse, s pomočjo inovativnih maket in prototipov. Vsaka naloga je vključevala intenzivne delavnice, ki so se osredotočale na zasnovo in izdelavo osnovnih okvirov, pri tem pa smo uporabljali opuščena in brezplačna gradiva.

KLJUČNE BESEDE

okoljsko primerna zasnova, projektivni biro, delavnica, preko prakse do znanja, Tyrespace©, PHS© (Pallet Housing System), Nomadic Allotment project©

ABSTRACT

Through comparative teaching and design methods, this study critically explores the principles of low-tech and high-design carried out in several international workshops led by the author in Spain, Slovenia, Chile and the UK, since 2004. This study focuses in the teaching and learning systems of Eco-design implemented in several design studios and compact workshops. Since 2008 I have offered intense 3-week design workshops as part of the BSc activity called 'Vertical Studio' that is carried out at the Welsh School of Architecture (WSA) in Cardiff.

The selected cases show how engaged students and tutors can rapidly develop key environmental and constructional skills such as spatial versatility, environmental awareness, lifecycle thinking and collaborative research by doing applied in innovative mock-ups and prototypes. Each studio brief consisted of intensive workshops focusing on conceptualisation and fabrication of elementary frameworks by using disused cost-free materials.

KEY-WORDS

eko-design, design studio, workshop, Research by Doing, Tyrespace©, PHS© (Pallet Housing System), The Nomadic Allotment project©

1. PREFACE

Eco-design aims at reducing the environmental impact of buildings or products, including the energy consumption throughout their entire life cycle. Eco-design is consequently the process of incorporating environmental considerations during all (as early as possible) phases of the design of buildings or objects. The aim is to identify possible design strategies and alternatives in order to reduce the urban environmental impacts throughout the life cycle. The adoption of the Eco-design approach has to focus on environmental balances, which are related to shifting of environmental problems from one stage to another and from one environmental slot to another.

Eco-design is for that reason closely related to life cycle thinking. All the case studies deal with the principles of *Reusability, Recyclability* and *Recoverability* of urban and industrial waste such as packaging and thus explore structural capacities to become inhabited devices such as playgrounds, dwellings or furniture. Low-tech fabrication is the optimal medium to test and materialise our Eco-design outcomes, throughout the method of *'bricolage'.* The term is borrowed from the French word bricolage, from the verb bricoler, the core meaning in French being, *»fiddle, tinker«* and, by extension*, »to make creative and resourceful use of whatever materials are at hand (regardless of their original purpose)«* (Merriam-Webster dictionary, 2013) or Do-It-Yourself (DIY), an elementary fabrication process that is 100% personal involvement and enhancement of manual skills, which are dormant due to an education based on abstraction and merely cognitive aspects rather than material competences.

2. TOWARDS A DEMOCRATIC DESIGN

Following the lesson of the *"Tower of Babel"* painted by Pieter Bruegel the Elder in 1563 (Kunsthistorisches Museum, Vienna), planet Earth seems a vulnerable "3D *game board"*. Its tools and components are not limitless. The current financial crisis is a good example of unscrupulous ruling. It demands a profound analysis on the collapse of speculative manoeuvres, with dramatic short-term consequences in our environment. What is evident, mainly in industrialised zones, is that we are undergoing the excess of a speculative "Culture of Consumption" and the pseudo-environmental notion of *"Greenism"*.

After reading the clairvoyant book called *"Six Memos for the Next Millennium"* (Calvino, 1988, pp. 101-124) – full of wit and erudition – I would like to highlight some key points which govern not just a visionary planet but ethically my lifecycle thinking by *underpinning progressive research by doing,* mainly through the bridging between design studio and personal research outputs. It reveals itself as a manifesto for democratic design. Generally a succinct synopsis of five cornerstones can be deployed as follows:

I. Empowered Diversity
Conflict, diversity and difference are constitutive elements of democratic coexistence. A democratic architecture has to identify obstacles and provide flexibilities, explore visionary scenarios, look at potential smart technologies and define new socio-spatial models.

II. Adaptable Living Systems: What Should We Play Instead?
Life is frantic and changing. Adaptability is a necessary antidote against reductive and dysfunctional schemes of living in motion. We must operate with progressive design approaches on potential architecture by exploring the spatial deterioration of the built environment in existing urban or suburban contexts and thus generating new spatial games.

III. Construction of Innovative Environments and Plural Design
Density and diversity are sustainable terms. All citizens have the right to have a sustainable social, climatic and built environment. For instance, any democratic architecture should support the use of decarbonised technologies and encourage passive energy systems in order to achieve adequate thermal performance, climatic protection, and functional flexibility.

IV. Playability
One of the most significant aspects of design lies in its ludic action. What level of playability do we take into consideration in the design process?

V. Social Accessibility
We must reject any architectural trend that excludes the ethic role and consequently the social promotion. Architects are certainly organic intellectuals because they are organizers of the existing and future built environment.

3. PLAYING WITH LESS

By studying historically the spatial evolution of architecture, we observe a gradual dematerialization of the space, from mass towards film. Contemporary space in formal cities is lacking of playability. Citizens do not engage enough in decision-making and, for instance, our streetscape becomes a territory of boredom and social agony. Nevertheless, space is a precious resource especially in informal cities and certainly communities in slums do engage more in the remapping and reshaping of their built environment. Users take an active role and the inventiveness of survival logic allows for the development of dynamic spatial frames ruled by three main factors: *Compactness, Lightness and Speed.*

Those factors are not just mere definitions but contain the new principles which rule the world of design. For instance, if we focus on the notion of compactness, it appears as a manifesto of *Elementarism* against oversized architecture. Smallness opens up unexpected trails of spatial production and provides new functional flexibility with spatial interoperability; do more with less. The sculptor Richard Serra stated that *»the biggest break in the history of sculpture in the twentieth century occurred when the pedestal was removed (Serra, 1994, pp. 141)."*

It provides new opportunities for modular and lightweight housing frames by reusing pallets shipping boards. It can be assembled or disassembled anywhere easily. It consists of expandable and contractible spaces within simple frameworks, and it is well-weatherproofed with passive techniques according to specific climatic contexts. Source: Dr. Suau archive (ECOFABRICA, 2012).

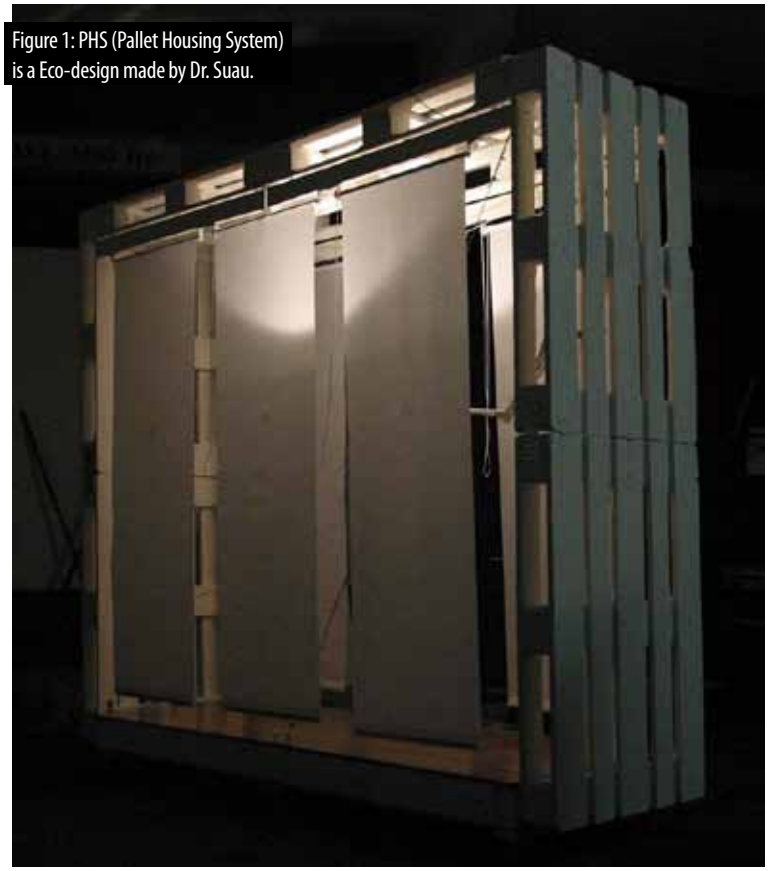

Figure 1: PHS (Pallet Housing System) is a Eco-design made by Dr. Suau.

If we relate this statement in architectural practice, what happens when foundations become smaller, lighter or simply removed? In this case, minimum would not mean minuscule but would imply removing from design its superfluous, redundant or useless properties. Consequently the search for elementary living is not a trend applicable in impoverished cities or cultures but is rather an appropriate strategy for dealing with playable design factors (Figure 1). What level of playability do we take into consideration within the design process?

Compactness inevitable implies lightness and speed of fabrication. Hence ludic research and workshops on compact-light-fast design should experiment in praxis and, above all, play with potential and existing obstacles. Apart from this, the design process should foster the sensorial exploration towards new space-frames by looking at potential appropriate technologies applied in our built environment. Thus, compact design follows the logic of minimum assemblage, a sort of "base kit" that is able of numerous combinations with few connectors.

4. JUNK AS MATTER FOR LUDIC FRAMEWORKS

The logics of reusing and recycling of manufacturing waste appear as a visionary game of research, which acquire a strategic role in the design of the built environment, the reconversion of productive and economical models and the reshaping of new living forms.

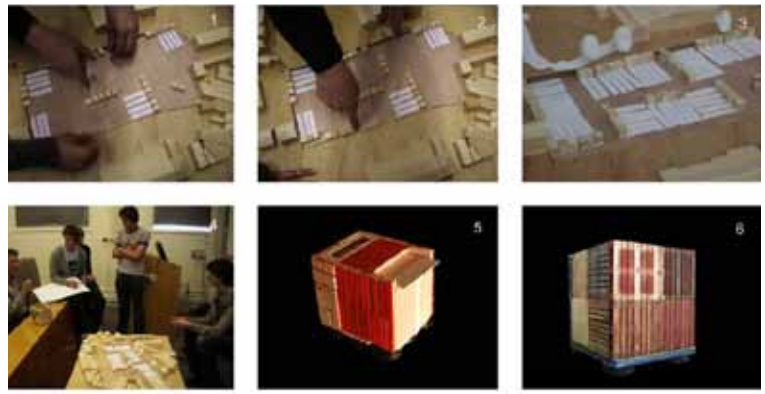

Figure 2: Mock-up design of Pallet House unit (UK, 2009).

Since 2004 I have investigated fast fabrication systems applied for emergency dwellings in urban or remote environments. The results are two prototypes: Tyrespace© and PHS© (Pallet Housing System) (Figure 2). They are mainly affordable solutions, which give response to mankind in natural disasters and *urban emergency* (i.e.: solutions for migration or low-incomes dwellers) in slums or the like.

The dwelling is a compact cube facing Equator. The roof is slightly tilted. The Direct Gain Systems occur by incorporating a large opening (glazed façade) facing south and a clerestory, which performs as an efficient solar collector (thermal buffer). Source: Dr. Suau archive (ECOFABRICA, 2012).

The designs are based on the application of manufactured waste, such as disused timber boards and rubber. Depending on the specific properties of each material or component, quality of constructional systems and the weatherproofing applied in each chosen prototype, different parameters of transitoriness and lifespan can be achieved. Some materials are more ephemeral than others, nonetheless structural. Each fabrication process reuses waste as structural frames with low-tech building methods:

I. Tyrespace© (Figure 3) is a-prototype based on the reuse of tyres. Geometrically it consists of a compact polygonal layout where walls and roofing are structured mainly by combining and strapping car and motorbike tyres. Several climatic simulations, has thoroughly been analysed and detailed based on constraints of the modular structure. The outcomes are elastic frames -*'webs'* or semi-domes that lightly touch the ground- with potential applications in sheds, bridges and games.

II. The PHS© (Figure 4) is an innovative housing frame. It constitutes an ecological response by reusing timber-shipping boards applied to compact dwellings. It can easily be assembled or disassembled. Neither cranes nor scaffolds are used to connect walls with floors or roofs because the bare pallet board operates like an adjustable ladder itself. There are two types:

Figure 3: *Tyrespace*© project is another new structural games. In 2008, I led a Master workshop at the School of Architecture PUC in Santiago de Chile. In two weeks, 6 small groups produced a 12m span footpath bridge only with car tyres. They carried out several empirical tests using all the components and properties of each car tyre. The preliminary structural tests with strapping connectors failed. Those frames required extra-stiffness. Nevertheless the use of strapping methods showed capability to build up random tissue. Source: Dr. Suau archive (ECOFABRICA, 2012).

Cubic and Triangular (A-frame) solutions. The modules are assembled and embraced mainly by boards, tensile components or metal connectors. These components are available in the shipping and packaging manufacturing. The PHS© has been climatically tested by employing passive techniques such as orientation, building shape, and colours, available local materials, and shading devices. They have similar base modulation: 80cms x 120cm. In terms of spatial distribution, the PHS© provides a central kitchen/bath core with sleeping room.

All these case tests are handmade fabrication systems. These geometries and modules are the result of the specific structuring potential. Summarizing, junk-frames formulate a rapid implementation of variable and interchangeable structures with interior adjustable buffers and panels capable to contain different types of occupancy and climatic variation. Each structure fosters the notion of a do-it-yourself *'kit'* and demonstrates a strong spatial playability and adaptability, in line with the need for decarbonisation of the built environment.

It consisted in the application of PHS© assemblage system applied in modular and mobile agro-devices. Source: Dr. Suau archive (ECOFABRICA, 2012).

Figure 4. The Nomadic Allotment project© was built at Borough Market, London (2010).

5. COLLABORATIVE RESEARCH BY DOING

The outcomes of the above mentioned research have been directly applied into subject-based design studio. Through innovative teaching and design methods, this study critically synthesises the principles of low-tech and high--design carried out in several international workshops and applied research led by myself. It shows how students can rapidly cultivate essential environmental and constructional abilities such as spatial versatility, environmental awareness and collaborative research by doing. Each studio brief consisted of intensive workshops focusing on conceptualisation and fabrication of elementary frameworks by using disused cost-free materials. What is a compact architecture today? What should our design objectives be for a sustainable future? What type of elementary framework should we achieve?

For instance, the design workshop called *"Nomadic Allotments"* built mobile allotments at Borough Market as part of the International Student Architecture Festival in London 2010 (refer to http://www.nomadicallotments.co.uk). Students learnt on agile fabrication, reuse of junk materials and urban gardening techniques. We obtained an international prize as the best "Recycling Project". The lesson of these series of workshops lies on the notion of eco-fabrication applied in undergraduate architectural education. The culture of each workshop is a learning tool and catalyst for "smart" design decisions, by using less and giving more. Each workshop shows how to edifice 'bridges' between praxis and research, based on flows of retrospective criticism and prospective visions for encouraging eco-friendly urban environments. Regarding the increasing levels of industrial waste released by our carbon-intensive culture, there is still a certain lack of inventiveness in how we might deal with these materials by *"upcycling"* and reusing them in the building sector, as innovative frameworks, thermal insulators or cladding.

What can we play instead by reusing industrial waste? Eco-frames aim to survey on the cultural notion of reuse and recycle applied in construction,

by using industrial disused materials such as metal, timber, rubber or any packaging components with constructional potential. Each of these design labs has achieved the following scopes:

A. Eco-fabrication by employing disused industrial materials
B. Collaborative work between students and staff
C. Environmental design by employing analogical and digital tools
D. Communicational, spatial and constructional skills by testing and building affordable designs such as shelters, allotments, playgrounds, furniture, etc.

6. PROCESS AND METHODOLOGIES

Eco-frames are the result of the consolidation of 5-year T&L development project and implementation in design studio at the Welsh School of Architecture (WSA). It is part of our spring term so-called *"Vertical Studio"* for BSc1 and BSc2, which was established in 2008. Since its foundation, I have been involved in its co-ordination for two years (2008 & 2009) and also led five different units:

A. Folding Architecture: http://www.cardiff.ac.uk/archi/studioproposal--spring-2008.php
B. Junk-Frame: http://www.cardiff.ac.uk/archi/studioproposal-call-for.php
C. Nomadic Allotments (Figure 5): http://www.cardiff.ac.uk/archi/v-studio-2010--studio_4.php , http://www.nomadicallotments.co.uk
D. The Art Box 1: http://www.cardiff.ac.uk/archi/v-studio-2011-studio_4.php
E. The Art Box 2: http://www.cardiff.ac.uk/archi/vs2012/pdf-html/12-the--art-box.html

The design process of this studio offers innovative analogical and digital techniques on sustainable design through the investigation of eco-design ideas and applications. This also enables me to share my professional and research expertise by exploring *'Design by Doing'.*

The learning method encourages 100% cluster work through the surveying, debating, playing and modelling of experimental spatial systems. The student design process is mostly edited digitally, thus allows easy exchange and accessibility. Physical models are constructed and tested manually and then constructed and exhibited in 1:1 prototypes. This is done so that students can train and develop a sensorial "eye-to-hand co-ordination" and sense of fabrication and craftsmanship, not just a mere visual experience. During group tutorials, instead of providing 30-minutes-tutorial-per--student, tutors increase the student monitoring by brainstorming and trafficking design ideas through group dynamics.

The fabrication of a mock-up allowed testing the structural capacities of a triangular framework made with only 3 shipping pallet boards. Source: Dr. Suau archive (ECOFABRICA, 2012).

Thus cohorts can also learn from each other. Within the interim review process, tutors and crits establish an appropriate medium to judge and assess work process. Therefore peer-reviews are an instant way to build up

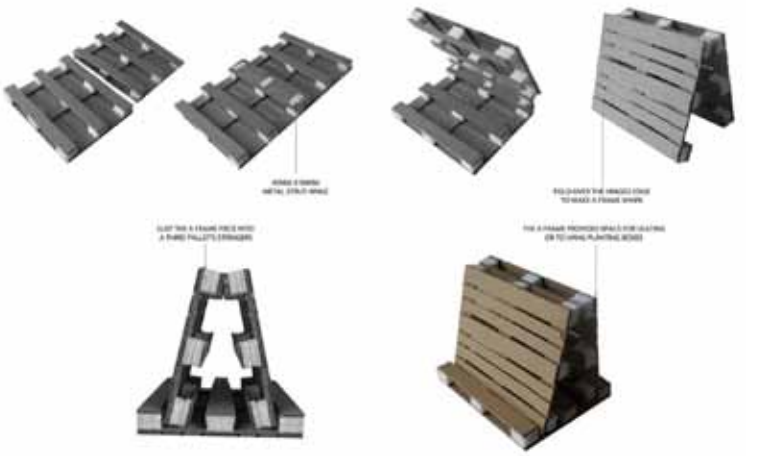

Figure 5: The Nomadic Allotment©, A-frame module.

operative critique by having different viewpoints. They create a favourable atmosphere for debate and collective celebration.

What is essential in each review is to evaluate the continuous process according to the given learning outcomes and brief's targets. Verbal, diagrammatic and written crit feedbacks are provided to all students.

A specific feedback pro-forma has been designed to record each presentation; highlighting the strengths and weaknesses of each artwork and providing alternative precedents and recommendations.

The recording part of each feedback review is filled in by a student who performs as scribe. Instant feedback is understood as a consistent, constructive and explicit mechanism for personal development, rather than a measurement for marking or a *"ticking box"* mechanism. The final marking is calculated as part of the annual portfolio. After processing and comparing these results, the next step was to reflect on the given assessment methods among colleagues, taking into account the student questionnaire.

7. TOWARDS A NEW LUDOLOGY IN DESIGN

Games are generally necessary systems that govern our daily life. Whereas games are often characterised by their tools, they are often defined by their rules. While rules are subject to variations and changes, enough change in the rules usually results in a new game. For instance, how can be possible to continue the car-based model of suburbia in emergent economies? What kind of decarbonised design might we conceive instead?

Spatial experimentations in Architecture require ludic strategies. Games provide new situations to subvert rules and turn conventions upside down, and the unpredictable convergences between concrete and intangible, even virtual spaces.

Following the wise reflections made by the French sociologist Roger Caillois (1992, pp. 323, 354-364), he defines the notion of game as a human activity that must have the following characteristics:

- **A. *Enjoyment:*** *the activity is chosen for its cheerful character*
- **B. *Instant:*** *It means circumscribed in momentary sense of time and place*
- **C. *Uncertainty:*** *The outcome of the activity is unforeseeable*
- **D. *Non-productive:*** *The aim is not prolific but adventurous*
- **E. *Governed by rules:*** *The activity has rules that are different from everyday life*
- **F. *Abstract:*** *It implies the awareness of a fictitious reality*

These points have personal applications in the teaching of architectural design. Certainly, a game is a form of play with goals and structure. I will illustrate this point with an experimental case. In 2008 a group of young architects and academics were invited to lead, reflect and produce new games with students from UIC, Barcelona. The experience is now available in a book called *"A Game in a Place: Vertical Studio"* by Carles *Ferrater and Carme Pinos* (Suau, Blanco, 2011).

The conventional studio was replaced by the notion of *game-lab*, a field for non-stopping brainstorming. Students and tutors became *play-makers*. The central theme was "*Game and Place*". The outcomes were assessed by externals and where showed in a comprehensive catalogue of gaming implements and games. This experience was an interactive, goal-oriented activity, with active agents to play against, in which players (including staff) could interfere/interplay with each other: Process setting the stage for the outcome.

8. FINALE

What games should we play instead? What can we extract from these lessons?

This study explored the potential and latent playability of any elementary design capable to conceive and fabricate new frameworks by constraints. To do so we need to **transform the classical sense of design workshop into a ludic lab**, self-ruled by spatial explorations, drifts and inventiveness in the design process.

Students also learn from the simplicity of non-object based design models, which deal with the dilemma of *High Design and Low-Tech*, through appropriate architectural strategies and affordable socio-technological solutions. After the completion of all studios, the brief has periodically been consolidated by surveying on new notions of reuse and recycling, applied in several environments, by using industrial disused materials such as metal, timber, rubber or any packaging components with constructional potential.

The power of playing with less in the studio opens new notions of spatial compactness; structural lightness and speed of fabrication. These experiments have been demonstrated through international design workshop (summer workshops; vertical studios or the like) led by myself and carried out in Slovenia, Spain, Chile and the UK. These cases showed a diverse range of space-frames based on the principles of Enjoyment, Instantness and Abstraction.

As result *"Life Cycle Thinking"* (LCT) applied in Eco-design can help us to identify new opportunities and lead to decisions that help improve urban environmental performance and image. This approach demonstrates that responsibility for reducing environmental impacts is being taken by young designers. Life Cycle Thinking provides a comprehensive perspective. As well as considering the environmental impacts of the design and fabrication processes within our direct control (DIY), attention is also given to the materials used, supply chains, product use, the effects of disposal and the possibilities for re-use and recycling.

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