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CONCEPTUAL NARRATIVES, ECOLOGICAL HEEDS, SOCIAL PURPOSES AND SUBJECTIVE ENDS OF NATURAL BUILDING MOVEMENT

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Ognjen Sukalo

University of Banja Luka, Faculty of Architecture, Civil Engineering and Geodesy
Bosnia and Herzegovina

Abstract. *Architecture built in materials colloquially named 'natural' represents one of the most autonomous and most iconic branches of building practices with high ecological considerations (i.e. 'green building'). However, specific character of this architecture, its broad, consistent and coherent approach has seldom been assessed. This research pinpoints broadest conceptual, social and political positions of Natural Building movement – an informal movement. Conditions are determined in which these positions have been formed, together with reasons for which these practices have been ignored in scopes of dominant architectural discourses. Special attention is given to cultural and geographical origins (North America's northwestern coast and its high arid continental Southwest), to integration of ethical, esthetical and lived experience, and finally to transformations of specialization, authorship and division of labour. Closing parts of the paper also offer examination and illustration of general range of explored phenomena. For this aim two specific architectural approaches are analyzed: Oregon Cob and Earthship, as well as findings and illustrations from construction of small experimental building constructed by the author in Bosnia and Herzegovina.*

Key words: *natural building, recycled materials, straw bales, cob, earthship*

1. INTRODUCTION

This paper aims at exploring the basic premises, practices and perspectives of informal and heterogeneous architectural movement which finds its basic unifying principle in use of building materials colloquially named 'natural' and (sometimes) 'recycled'. Out of very broad initial circle, with differing foci and various accented practices and materials, specific architectural methodologies and philosophies have

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Corresponding author: Ognjen Sukalo, Faculty of Architecture, Civil Engineering and Geodesy, Vojvode Stepe Stepanovica 77/3, 78000 Banja Luka, Republic of Srpska, Bosnia & Herzeovina
E-mail: osukalo@aggfbl.org

emerged which transcend technical or even ecological aspects of the building process. Although final formal products throughout the movement are rarely able to compete with mainstream or vernacular morphologies, some themes seem to have emerged that point to fields that have been forgotten, neglected, discarded or that could not have been comprehended by dominant systems of architecture. One of the principal tasks here is in defining the way in which this informal movement covers the themes that usually dwell in domain of taboo for contemporary industrial architecture – including the 'green' branch of industrial.

It is important to note that this text significantly questions the nature of connection between *approach* cultivated within natural building and the one found throughout industrially produced ecological architecture. Differing starting points, discontinuities, different public status and even conflicts found between these approaches, all this is often blurred by common focus of sustainability. Also, when 'disregard' of the dominant discourses is claimed, it is not that sporadic (or massive) use of certain natural materials in contemporary building industry that is overlooked; these technical practices (with their 'green' marketing potential) are obviously being slowly integrated since late nineties [1]. In contrast to the high specialization evident in mainstream use (Fig. 1), it is the entire architectural worldview of natural building that is ignored within milieu of *hocharchitectur*.

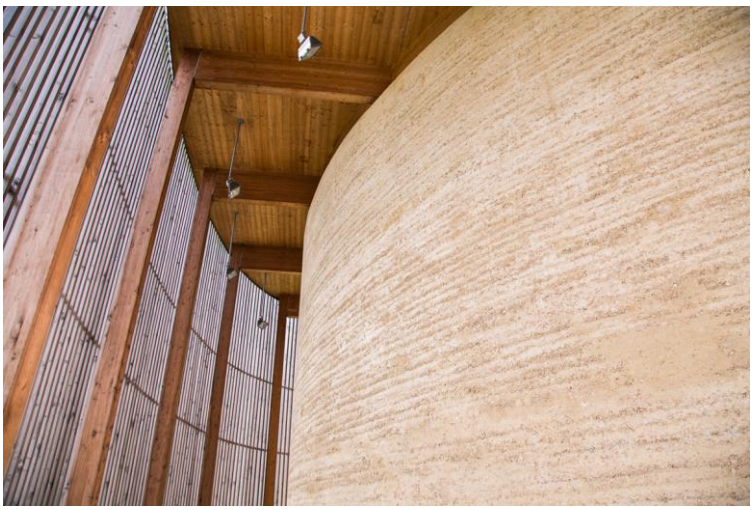

Fig. 1 Naos wall of Chapel of Reconciliation, Berlin (1999) constructed in rammed earth. Architectural design: Rudolf Reitermann and Peter Sassenroth; design of rammed earth wall: Martin Rauch
(source: T. Webster, under a CC-BY 2.0 license, 2015 [2])

Special regard towards social and subjective consequences, towards authorship, community and finally towards architectural form all together define a unified and coherent approach of natural building movement. Properties of this approach will be examined with intention of highlighting the possible final implications of responsible architecture – beyond ideological curtain of sustainability.

Since we are dealing with rather broad phenomenon that harbours great variability of technical procedures and conceptual perspectives, research will encompass both abstracted basic positions (with their potential end consequences) and specific building philosophies and practices (with wide scope that they illustrate). Independent endeavours of the author of the paper at construction of a small building of natural materials will be used as an illustration of specific contextual needs of such architecture.

2. General Methodology

Informal natural building movement is indeed informal in many of its aspects (with even the term 'movement' being debatable). Besides it being treated – with rare exceptions – as a matter of applied technologies or being plainly ignored within production of academic literature, basic premises of natural building are expressed in a relatively limited number of (published) texts, almost never 'objectively' distanced, but always subjective and with intent of enhancing subjectivity. These texts often have prime goal in disseminating technical information (for mostly lay readership) and it is necessary to specifically track nontechnical positions. Thus this paper inevitably finds itself in methodological position of *mapping* of a conceptual terrain, it is directed by lack of academic literature on the subject and it must refrain from detailed examination of fragments.

Full ideological potential of natural building movement – namely its capability of producing narratives that principally refer to things other than building materials and techniques – was probably reached during the first decade of the twenty first century. The majority of key texts are dated in that decade [3]. Not only do later progressions employ the second generation of authors (after the 'pioneers'), but a more eclectic and technically focused approach [4].

Perceived in full scope of its intentions and contexts, natural building cannot be assessed through the obvious – the use of straw or earth for construction of buildings. It is necessary to investigate narratives that precede decisions on use of materials and, reversely, it is necessary to understand architectural and subjective narratives that arise on materiality as such.

Inside this domain, it is not possible to anticipate full replicability of research. Insistence on subjective experience requires entering a subjective examination of certain processes of (this) architecture. Exactly that was an impulse for the author's experimental construction that will be assessed further in the text. Therein also lie limitations of objectivity (perceived as detachment). The author of this text is, in a certain way, actively and subjectively involved with the phenomenon he explores.

3. Natural Building: Scope of Definitions

Honoring its many different aspects, Michael G. Smith defines natural building as:

> […] Any building system that places the highest value on social and environmental sustainability. It assumes the need to minimize the environmental impact of our housing and other building needs, while providing healthy, beautiful, comfortable and spiritually uplifting homes for everyone.

> Natural builder emphasize simple, easy-to-learn techniques using locally available, renewable resources. These systems rely heavily on human labor and creativity instead of capital, high technology and specialized skills.
>
> Natural building is necessarily regional and idiosyncratic. (…) Everything depends on local ecology, geology and climate (…) This process works best when the designers, the builders, the owners and the inhabitants are all the same people [5].

By firmer contextualization, natural building movement can be recognized as emerging from independent experiments of various individuals and groups that started to configure consistent conceptual patterns during 1980ies – mostly in the United States. Activities within this early explorations where primarily determined by particular technological focus (i.e. 'building technique') – on a broader background of clear-defined premises of environmental sustainability. The defining techniques and materials involved were:

- Foundations and stem walls built with stone, gravel or (at the other end of 'natural' spectrum) bag/tyre-contained earth, sand or gravel.
- Wall systems of stone, non-fired earth (as a sole material or combined with others), straw bales, mixtures of straw and clay, wood, bag/tyre-contained earth or sand. General exclusion of predominantly wooden wall systems is notable.
- Roof construction of various materials and force transferring designs (often focused on reduction of use of wood) and with broad range of roofing materials: thatch, wood and, most notably, roofs with living vegetative cover ('green roof').

The above list obviously reveals a certain tolerance towards synthetic materials – even the non-reused ones. The iconic and oft-exploited green roof is practically never built by traditional means (with birch bark, clay etc.), but with synthetic membranes with choice of materials well elaborated throughout even the most 'natural' or 'simple'-oriented literature [6]. In contrast to highly placed environmental impact bar, 'purity' of any kind is rarely sought after.

Almost exclusively, emphasis remains on simple forms of housing architecture, as well as on small public or community pavilions.

Being nested in a broader context of self-sufficiency culture, and with many buildings rooted in rural backcountry, the natural building remains loosely interconnected, albeit with growing number of publications and educational events. Despite being mostly technical manuals, these publications often have well integrated and well expressed ethical premises [7], which also keep being propagated to mostly lay and semi-professional audience through system of workshops and apprenticeships [8]. Trade guild exclusivity is foreign to this milieu, and the whole (informal) movement is not being defined by belonging or attaching itself to formally enclosed building vocations or trades. Ability of applying information circulated is not set up as an arbiter of the way in which information is being shared.

Technology of wall construction is the source of primary division, although some authors accentuate the materials by referring to 'straw and earth based building systems' [9]. The most distinguished wall systems are: *straw bale* (being by far the most integrated into the mainstream), *rammed earth*, *cob*, *earthbag* and, in non-structural systems (infill): *wattle and daub*, *straw wattle*, *light clay straw*, *cordwood* (also occasionally structural in smaller buildings), '*hempcrete*' (hemp with lime) and non-structural straw bale [10].

In time, several of these 'systems' inside of specific creative dynamics managed to surpass the basic level of technique and environmental heeds and proceeded to develop and integrate elaborate architectural principles enlivened through discussion and practice of distinct ways of *living*.

4. Ethical Basis: Ecosystems and Social Systems

The initial and most fundamental premises of natural building are largely defined by a set of ethical positions. The primary and the obvious is the reduction of environmental impact of the building process - in its broadest temporal and procedural scope: extraction, processing, transport, construction, lifetime use and finally disposal. Inside these same stages similar considerations are placed on issues of health of people coming in contact with materials and processes of the building. Nothing here falls short of usual proclamations and general discourse of 'green building' or even 'sustainable development' – not nearly considered *alternative* and more often than not regulated or even enforced.

What sets the difference between natural building and industrially produced 'sustainable architecture' is more rigorous application of aforementioned ethical and technical principles, and then markedly different orientation in socio-ecological realm. In natural building milieu dominant paradigms of economy are seen as requiring, promoting and producing the idea and processes of *growth*, of which mainstream architecture (being 'green' or not) is consequently seen as a vehicle and enhancing mechanism. Ianto Evans, one of the pioneers in contemporary revival of earth as building material (with a diploma of landscape architect and experience in education of architects) succinctly illustrates specialized role of mainstream architecture:

> Architects are somewhat as physicians. Their job is to prescribe the products of industry. They basically write in that illegible handwriting that all doctors have [11].

Following this logic further a perspective arises which understands that even when qualities of 'sustainability' are sought after, the mainstream architecture sees biosphere and 'resources' as mere objects and means. Inside of this reified reality, it is only adjustment between use and destruction that requires adjustment, so that basic impulses of growth and spatial expansion can proceed unstained.

Natural building thus aims at establishing a distinct ethical framework for defining and satisfying individual and social needs for spatial (architectural) artifacts. Inside this framework ecological, geologic and climatic conditions are not mere problems or riddles to be solved, but a primary reality and reference. Here *nature* is set not only as a starting point but also as a final and wished destination. It is considered as a universal parameter; values, esthetic experience of life and purpose itself are put as a measure of authentic relationship with nature. Philosophical meditations of Arne Næss termed (by Næss himself) as *deep ecology*, having significantly (although ambiguously) influenced grassroots environmental movements of the West [12], most precisely frame this 'eco-centric' approach. Næss discusses architecture only marginally, but some of his general positions adequately illustrate the architecture aspect of deep ecologist's stance towards technological anthropocentrism:

> The essential ingredients for a technocracy are present when the individual and the organizations in which the individual functions become more occupied with means then with ends, and more occupied with subordinate ends (buildings) than fundamental ones (homes) [13].

Through such perspective building (and especially building of a home) with materials which are directly given in their natural form becomes a process of defining one's most basic existential position. Viewing (and practicing) architecture and the process of construction in this manner is obviously not exclusive property of a small architectural and environmental movement. Vernacular architecture is often interpreted and construed through attribution of such existential impulses [14], as well as architecture in general (as in Heideggerian theories of Christian Norberg-Schulz [15]).

Natural building (movement) distinguishes itself in this sense from vernacular most certainly by context. Traditional ways of building remain the only possible within traditional societies and traditional economies although a 'trickle' (as Amos Rapoport calls it) of high architecture influence can almost always be identified [16]. On the other hand, inside of (post)industrial context, building with non-processed natural materials with many structural properties inferior to their industrial parallels becomes a clear political act or statement and it may also be a quest for a crosscut towards a sense of purpose and a differing regime of reality. Additional difference between vernacular and contemporary natural building – and one of the main reasons why the latter cannot be regarded as 'the new vernacular' – is a necessary and self-conscious exploration of a distinct formal repertoire. In both socio-political and formal architectural regard, the all-pervading presence of industrial materials remains as contrast and a background for expression of purposeful choice.

Efforts on exploring and integrating *genius loci* are not alien to dominant forms of architecture, but natural building is distinguished by not accepting formal allusions as a sole parameter.

Social implications in use of natural building materials are fairly easily assessed. It is again refusal of accepting formal codes as a dominant factor in relationship between architecture and society. What else is refuted is 'acceptance' of social sacrifices for the sake of high architecture produced by professionally detached segments of society – architects and builders. Use of minimally processed materials such as straw, earth, river sand, fieldstone and roundwood is seen as an adequate response to a great array of negative conditionalities brought to social and ecological realm by dependence on industry and specialized complex of building techniques and technologies [17]. At the same it is perceived that the production of industrial building materials generates cycles of not only environmental degradation, but also of labour/time selling, general creative abatement (through specialization) and of purchasing specialized creativity – a social and personal dynamics to be deserted [18].

The do-it-yourself attitude and approach is firmly embedded within natural building movement and is based on comprehensibility of building techniques, low level of structural complexity of predominant building types, as well as on availability of materials. Strategies of evading such socio-economic institutions as housing loans are regularly explored and very low building costs (from 500 to 5000 USD) are sometimes claimed [19].

Ways of relating to regulations and building codes are versatile and highly influenced by local legal context and personal attitudes. During more than two decades building

codes in both US and EU have constantly increased integration of natural building practices. Still, relationship with regulations is more expressed as a question of concept than a technical consideration. Discussions often include tactical bypassing of codes - which are viewed as means of strengthening building industry [20].

5. HISTORICAL PROGRESSIONS

Genealogy of this heterogeneous movement is composed of several mostly separate lines. The first one springs through traditional building crafts (and building practices in general) – whether a living tradition is in question, as in 'underdeveloped' countries, or an institutionalized and fixed as in conservation practices of the 'developed' ones. This line remains in domain of rather straightforward technical and formal.

The second line of influence emerges from total context of building industry in United States and even from some tendencies in general material culture of this society. Movement of such radical alternative approach could have gotten enough impetus only in socio-economic environment characterized by almost unhampered wastefulness. Consumer appetites of this (building) culture not only inspired quests for alternative ways of constructions, but also enabled emergence of significant subgenre on natural building based on steady stream of discarded materials ready to be reused and repurposed. Literature within NB consistently insist on the role of building process as a great environmental destructor, and further accentuates United States as having the leading role in such activities [21].

The third line of formative influence comes not primarily from the world of architecture and building. Pioneer work in contemporary natural building application was active in many parts of the world during the last third of the 20th century: from experiments of Hassan Fathy based in North African traditions and social needs [22], through earthbag domes of Iranian-American Nader Khalili [23] to US owner-builder focused Ken Kern [24] and many others. Yet, during that same period, 'contemporary' in natural building was only acceptable and conceivable within living vernacular traditions [25]. For acquiring impulse and general character of a movement and for becoming a contesting part in the general field of competing cultural models (not just a remnant) - a special cultural climate was required. It was met primarily in the region of Pacific Northwest, from northern California to Vancouver Island and British Columbia. Natural landscape of majestic beauty, well established tradition of environmental consciousness with model city policies (Portland) one of the oldest (Sierra Club) and largest (Greenpeace) institutionalized environmental organizations in the world) and proclivity to grassroots organizing [26] all produced environment rich in mutual connections and tendency to formulate principles [27]. Thus principles of natural building movement often reflect this particular context - as in the case of tacit omission of dominantly wooden structures from NB etiquette, which resulted in peculiar development in which building practices originating in wood deficient contexts (either from arid regions or from medieval over-plundered Britain) were being touted as 'natural' in contexts of most exceptional (original) forest cover. The contrast of 'available' wood and reserved and cautious use of it further accentuates ethical and environmental considerations as a source of architectural concepts [28].

Non-traditional architectures which emphasize application of non-industrial, natural and even discarded materials could have been, in their initial phases, termed only as 'alternative'. The strength of the idea of progress – in architecture best illustrated through paroxystic techno-fantasies of Buckminster Fuller, Yona Friedman or *Archigram* – had colonized comprehension and imagination within architecture, that any approach refusing to rely on force of industrial impulse might have been regarded as nothing more than aberration. Sym van der Ryn cites an example of 'excommunication' of a researcher form South Dakota State University in 1930s for venturing into (successful) experiments with rammed earth walls [29].

Reduced to a status of creative whim or a benevolent amateurism, these architectures were not in position to define their own directions of development as long as all possible futures were inhabited exclusively by megastructures and thorough automation.

Energy crises of the 1970s, followed by rise of neoliberalism in the 1980s slowly melted faith in Progress. Inside dominant discourses of architecture this coincides with rise of postmodernist relativism and cynicism [30]. Following its own logic and purposes, the natural building *movement* slowly starts to emerge on a marginal wave of non-progressivist (although not anti-progressivist) tendencies such as permaculture. With gradual withdrawal of super-technological imagery from collective imagination of the future, architecture of stone, earth, straw or discarded tyres was able to raise from assigned domain of marginal 'experiments' and start exploring even the particular ways of living.

First decades of 21st century, besides ever-progressing environmental degradation, brought to light the question of diminishing resources with possible *peaks* of fossil fuels being the most noted. With such possibilities that question any complex industrial system, even the mainstream 'sustainable architecture' might be in position of (re)valuing extremely local, non-processed and low-tech materials and practices.

6. Technology, Esthetics and Lived Experience

6.1. Materials and *Gathering*

Practices of natural building movement tend to integrate technological processes of building construction into the whole of esthetic experience:

First, specialized contractor services are rarely used, and great emphasis is put onto experience of collective and even communal voluntary activity. As noted earlier [31], the future inhabitants are most often fully engaged.

Then, the provision of building materials by itself can acquire specific esthetic, ethical and existential qualities. If possibilities of using materials from immediate or nearby environment are explored [32] the individual or a group might actually be leaning toward experience of defining one's own place in the world (with naturalistic parallels in nest building). The esthetic experience of this quest for materials evinces primarily through wakeful, alert and incessant exploration of the landscape. Key literature on natural building often contains guidelines (both technical and ethical) on ways of material collection. For example, content of clay in the soil is assessed by specific vegetation in micro-locations [33]. It is evident that this kind of active visual connection with the landscape is not only esthetical; it can additionally deepen existential relationship between local environment and people intent on *inhabiting* the landscape. Further, the whole of experience is not only visual, but also a kinesthetic one - primarily in the act of

transporting of materials which, because of the total context, has the ability to transcend the usual notion of *work*. Finally, esthetic in its nature (and again, not only esthetic) is also exploration of sources and discovering of potential new purposes of discarded items and materials. This refusal of notion of *waste* in an existential sense takes the image of the world towards a sense of ever-emerging *freshness*.

The ethical component, which usually (in both quest for natural materials and repurposing the discarded) precedes the esthetic and existential one, potentially becomes transformed from ecological heed to sense of ecological belonging.

Sym van der Ryn notices general presence of 'spirit' in natural building materials as a key to their renewed allure – matched with downfall of machine-made esthetic standard [34]. Further, it could be said that reduced techno-mechanical intermediacy between materials and the actual builders enables for esthetic and even ontological expression and revelation of materials to builders – a process greatly aided by reduced or nonexistent chemical harshness of clay, straw, unprocessed wood and alike. Thus direct and almost archetypal characteristics and 'characters' of materials arise in contact with human activity. The weight and solidity of a stone respond to a heavy work of almost mythical atmosphere; plasticity and pliability of wet clay are akin more to play than labour; elastic strength of wood embodies overall biological aspect of building process.

However, it is not necessary for any of these activities to fully attain described levels of subjective experience. Many phases of the construction process can be automated and numerous experiments in that direction are presented even in the most zealous of literature on the subject. Also, materials are often simply purchased (as is almost exclusively case with straw bales). Still it is important to stress that architecture of natural materials potentially defines its domain of *esthetical* through a group of phenomena fairly larger than mere *completeness* of architectural form.

6.2. Formal propositions, practices and elements

Natural building movement bases the epithet of 'natural' largely on the use of particular materials. Quite rarely specific formal principles and practices are labeled the same way – as 'natural'. Evans speculates on several basic tendencies in nature, proposing them as a source of guidelines and principles. He observes that:

- Nothing is ever created or destroyed; it merely changes form (…)
- Everything gradually falls apart (…)
- Everything is unique (…)
- There are no monocultures in Nature (…)
- Nothing ever stops moving (…)
- Nature has a series of fundamental geometries, each for a certain set of phenomena at a particular scale (…)
- Life quickly occupies any niche it can exist in (…)
- Nature uses just as many resources as are necessary and no more (…). [35]

It is obvious that some of these 'tendencies' are assessed with architecture in mind, but Evans does not make a direct leap towards potential principles of form. He rather juxtaposes natural with architectural tendencies of traditional (predominantly rural) cultures, leaving the system open. These vernacular inclinations are defined as:

- Don't build any bigger than you absolutely need (…)
- Use whatever materials are close at hand; fashion your architecture around them (…)
- Consider the advantages of conjoined and clustered buildings (…)

- Never demolish a serviceable building if you can change it or add to it to accommodate new uses (…)
- Pillage abandoned buildings for components (…)
- Accept and encourage the natural decay of natural materials (…)
- Understand that straight lines, flat surfaces, and right angles are ecologically expensive (…)
- Make warm, cool, or dry places where it suits people to be (…)
- Build incrementally, as you can afford to, without borrowing money (…)
- Decorate your building as you build (…)
- Involve the whole family in house construction (…)
- Don't try out complex new ideas on a building you will live in (…)
- Build to take advantage of Nature's basic rhythms, shapes, processes, and time-scale
- Never buy anything new if you can re-use an old one, borrow it from somebody, make your own, or as a last resort, buy it second hand. [36]

The refusal to reduce the domain of esthetic down to completed and pre-designed form is noticeable once again. Some of the principles reveal propensity to sharing or even relinquishment of parts of creative process to factors more or less involved. Direct realization of imminence of decay, as well as insights into relation between form and decay, potentially and ultimately lead to architecture that is deeply *effortless*. In principle, such architecture does not aim to permanently *transform* matter of building in an effort of preserving fixed social memory, but seeks for ways of *adjusting* the matter of building to proper use within cycles of emerging and decaying – with purposes of cultivating life.

Inclusion of a group or community in construction process is combined with principle of simultaneous building and decorating and further excludes the notion of definitive or definable author. It is however noticeable that this principle of ad hoc embellishment is mostly applied through plasterwork or use of particoloured repurposed glass items. It often presents questionable formal accomplishments, arrived at with limited and cliché set of themes and patterns. Regularly appearing are bas-reliefs of sun, vegetation and other imagery that alludes to 'connection with Nature'.

Contrary to some opinions that have emphasized the renewed whole of authorship within figure of master builder [37], in a general sense it can be recognized that in architecture guided by aforementioned principles the role of author becomes progressively less fixed and clear; 'author ' is dispersed and expressed through an array of various factors and operations – even more so because of: multiple phase and long term construction, recognition and application of successful patterns, restriction of formal (and technological) experiments in housing architecture, conjoined and group-form architecture, as well as organizing of architecture around readily available objects (found in nature or repurposed). As a final note, this scattered authorship of non-traditional architecture of natural materials partly compensates a certain frivolity that is noticed in comparison with traditional (typologically structured) architectures.

6.3. Technological choices

One of the principal axioms of contemporary natural building is an understanding that technology does not represent a mere neutral means to a certain end; it implies a wide scope of not only environmental consequences, but also social conjectures and spiritual orientations. At the same time, manual craft or art refinement is rarely sought after (as in

historic revival movements). Such tendencies could hardly form inside movement comprised mostly of amateurs – often city dwellers seeking grounding in creative manual activity. Again we see (kyn)esthetic experience of building with one's body put before need for formal result and completeness.

Regarding aforementioned amateurism, significant exceptions must be noted. First, during at least two decades of active presence of movement, already several generations of neophytes have come of age and attained specific building knowledge and skills. Also, long term master-builders have made significant contribution in movement formation.

Soil (with adequate clay content), sand, straw, wood and generally most of the materials usually regarded as natural, are without reasonable doubt able to form buildings of satisfying strength and durability. This is amply illustrated by long vernacular traditions. However, these materials are not up to the task of creating 'imperishable' firmness of reinforced concrete or steel. Natural building necessarily has to include elements of decay and *perishability*. By being less of a monument or a visual latching of social realities and more a medium of the flow of life, architecture of natural materials is more directed to closer relation of people and buildings – both sides sharing similar level of corporeal firmness and durability. This is finely illustrated (an example from a traditional culture) by Martin Prechtel, a long term member of Tz'utujil Maya community:

> In the village, people used to build their houses out of traditional materials, using no iron or lumber or nails, but the houses were magnificent. Many were sewn together out of bark and fiber. Like the house of the body, the house that a person sleeps in must be very beautiful and sturdy, but not so sturdy that it won't fall apart after a while. If your house doesn't fall apart, then there will be no reason to renew it. And it is this renewability that makes something valuable. The maintenance gives it meaning. [38]

Ironically, buildings made of industrially produced materials often fail to fulfill time span promised by firmness of their components. When dilapidated, they are usually removed and replaced by architecture that doesn't keep the slightest memory of the previous state. Contrary to that, earthen houses of southwestern Britain or earthen multistory buildings of Yemen, periodically renewed and adjusted, achieve a *living* of several hundred years.

7. Range of Approaches

Several different focused themes, design practices or approaches to architectural form can be identified within current constellation of natural building. Additionally, differing attitudes towards (industrial) technology are sported – appropriately illustrated by extremes of photovoltaics and voluntary candlelight. Still, the whole movement, however heterogeneous, has seldom produced 'strains' that transcended technical aspect of applied materials and succeeded in creating more complex systems of architecture encompassing a range of technical, axiological and esthetic (clearly defined) positions. Further in text, two of such strains will be additionally explored – not only on account of their coherent and rich ideologies, but also for standing at two extreme ends of the movement. A final study will outline specifics of approach and context for an experimental building constructed by the author of this paper in period of 2011-2014.

7.1. Oregon cob

Building material with *cob* as one of its traditional names is roughly comprised of sand, soil (with significant clay content) and straw in various ratios [39]. Contemporary explorations of this material and building technique in United States (whence its popularity was dominantly promulgated from) is related to cob traditions of Wales and southwestern England - particularly Devon [40] and to US-based work of Welsh architect Ianto Evans. Early American experiments with cob were an integral part of cultural climate of northwestern Pacific coast. These experiments, performed from 1980s onward [41], produced formulations of architectural principles quite different from traditional British. The key text of this current is (previously amply cited) *The Hand Sculpted House, A Philosophical and Practical Guide to Building a Cob Cottage*.

Apart from technical improvements of traditional techniques (from sharpness of sand and length of straw to mixing procedures and application patterns [42], some of the distinct properties of Oregon cob (as a complete system) are as follows [43]:

- Significant emphasis put on placement of building within exiting ecosystem – especially on locations without previous building activity. This principle also requires minimal adjustments and interventions in surrounding vegetation and micro-relief (Fig. 2).

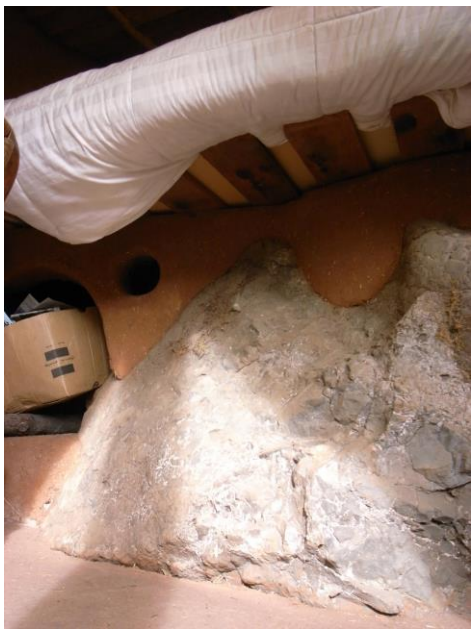

Fig. 2 Bedrock house (designed and built by Cob Cottage Company and apprentices) integrates existing bedrock in its architecture; North American School of Natural Building, Coquille, Oregon (source, B. Liloia, under a CC-BY 2.0 license, 2009 [44]).

- Devoted attention for ingathering of materials: Both naturally occurring and discarded materials get adequate attention. Among discarded, oft-mentioned is the ‘urbanite’, i.e. discarded broken pieces of concrete used mostly for stem-wall construction.
- General emphasis on appropriateness of small buildings - whether for housing or other purposes (Fig. 3).

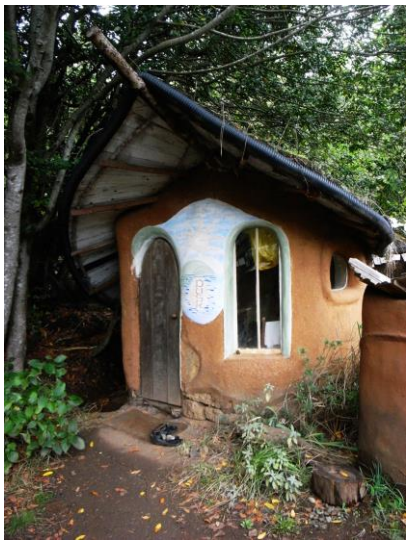

Fig. 3 Dusk house (Cob Cottage Company and apprentices; North American School of Natural Building, Coquille, Oregon): a typical exhibitory small building with varying intensity and regime of use (source, B. Liloia, under a CC-BY 2.0 license, 2009 [45]).

- Curvilinear geometry (in most instances of floor plan; Fig. 4). Several reasons are put forward (including enhanced stability), but of furthest consequences is alleged existential and anthropometric/-morphic adequateness of curvilinear spaces to human body, movement and perception. It is important to note that cob as building and artistic medium, being mould-less and pliable, invites to experiments with curvilinear walls – sometimes superficial and formally questionable.

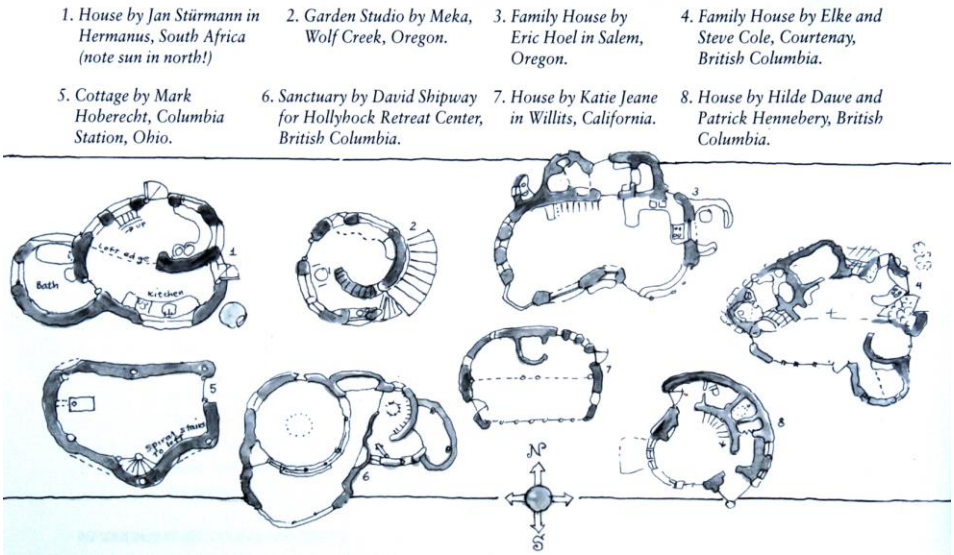

Fig. 4 General morpho-typology of architectural plan of Oregon Cob. Out of eight examples, six are built in region of Pacific Northwest (illustration by D. Bednar from I. Evans, M.G. Smith, L. Smiley, *The Hand Sculpted House*, p. 76, see note 3).

Pliability and plasticity do not only lead to curvilinear floor plans; fine tapering of walls from ground up is sometimes used to achieve a sense of house growing out of the earth (together with reduction in materials and lowering of gravitational center of the walls).

- Avoidance of abstract spaces and forming architecture around immediate human activity. This is closely linked to aforementioned curvilinearity.
- Strong emphasis on construction process and reduced attention given to intricacies of completed form or design process. Mixing of materials for cob is often used within Oregon cob milieu both as a basic illustration and as defining experience. It is done by mixing sand, clay-rich soil, straw and small amounts of water in a rhythmical threading action, mostly with bare feet (Fig. 5). It is claimed that this kinesthetic experience easily transcends limits of 'work', blending into play and reaching into qualities of ecstatic [46]. It is further claimed that cob construction process, carried out in this fashion, holds certain therapeutic properties [47].

Fig. 5a,5b Mixing cob by feet
(image courtesy of M. Šukalo 2012).

- Insistence on strong connections between architecture, building process, way of life and broader natural and social contexts. Literature and courses directly related to Oregon cob, besides technical, include special themes such as: home food production, ways of exiting usual economic dynamics, simple living etc [48].

A short poetic essay by one of key early proponents clearly drafts positions regarding architecture and life within this particular *school* of natural building:

> Keep it small, simple, beautiful.
> Listen to what the building wants to become.
> Use found and natural materials.
> Know just enough to start, then start.
> Finnish what you start.
> Spend only your own money, reluctantly.
> Use simple tools well.
> Share the skills.
> Build friendship, not just a home.
> A home is just shelter, not your life.
> Move on to other things [49].

7.2. Earthship

Oregon cob, with its gentle approach to context, careful exploration of 'Nature's principles', almost sacral approach to materials and construction, derives almost ultimate (and at the same time central) premises of natural building. On the other end of the spectrum, on its outer boundaries, practically an independent (sub)movement and concept is found: the Earthship. It is completely based in research and practical experiments of Michael E. Reynolds, from early 1970s until present.

Starting on usual positions of natural building, that is to say, regarding the usual industrial-based architecture as being wrongly founded in its relation to 'the planet' and to human needs, Reynolds initiated its experiments with discarded materials immediately after completing his formal education in architecture [50]. Gradually, these experiments produced several distinct premises:

- Notion of 'natural materials' expands to include many discarded items of Industrial civilization: they are ubiquitous, already highly structured and if structurally fit and harmless to human health, they invite to be used [51].
- Independence in infrastructure and energy supply should be regarded as one of the key elements of (housing) architecture [52].
- Specific skills required and level of technology included should closely relate to general social need for adequate housing [53].

Practical considerations of Earthship include [54]:

- Application of passive solar design such as dominant (and sometimes exclusive) orientation of openings towards equator, partial or complete earth embankments or dug-ins towards pole, glazing angle aligned according to winter sun, accentuated use of thermal mass (both of building itself and the earth embankment), etc.
- Integrated generation of electricity by means of sun or wind.
- Rainwater harvesting, as well as
- Guiding water through several distinct phases of use and treatment, and integrating it (appropriately) with food production.
- Food production inside and around the house. Space reserved for most of the production is equator-oriented and completely glazed annex/hallway/greenhouse, mostly with graywater irrigated plants. Smaller animals are occasionally included.

Distinct construction techniques consist of:

- 'U' shaped constructive and spatial modules [55] constructed with reclaimed automobile tyres filled and compacted with earth *in situ* (Fig. 6).

Fig. 6 'U module' of an earthship in construction, Brusnica, Serbia
(image courtesy of S. Ignjatović and Earthship-Serbia, 2012).

- Partition walls comprised of used aluminium cans and glass bottles within cement or earthen mortar [56].

Being positioned through a set of mostly technical determinants, the concept of earthship translates into corresponding technology-accentuated visual appearance. Passive solar design elements determine the general volume (visual orientation, angles etc.) and its relation to surrounding landscape (earth embankments and dug-ins). Onto such background, specific technologies (photovoltaic panels, wind turbines, solar septic tanks and ventilation roof openings) are applied as visual elements, defining the silhouette. As a third visual layer, an assemblage emerges consisting of integrated garden beds, reused cans and bottles, colour-pigmented walls, ready-made sculptures and other (intentional) signs of amateur and communal building process (Fig. 7).

Fig. 7 An earthship, built according to 'Earthship Global Model', Taos, New Mexico (source: Biodiesel33, under a CC-BY 2.0 license, 2011 [57])

Gathering of such various forms and structures is given not as mere visual act (of questionable integrity), but as result of a consistently utilitarian approach. Finally, earthship aims at being not only architectural concept or a type of construction, but a coherent spatially and defined approach to life and society, thus opening, form utterly unexpected end, connections to *vernacular*.

The context of high arid north of New Mexico, where earthship was initially conceived [58], besides providing reasons for explorations into thermal mass (with cold but sunny winters), also endowed the movement with specific rugged 'character'. Contrary to meditative and gentle approach of Oregon cob, Reynolds focuses on 'getting the job done' [59].

7.2. Narratives of subjective involvement

During four consecutive summers, from 2011 to 2014, author of this paper explored natural building (movement) through direct participation (Fig. 8). Previously examined positions of this particular but coherent and whole strain of environmentally and socially conscious architecture were put in personal and ecological contexts specific to the author – a process that raised significant considerations accentuated themes regarding natural building in general.

Fig. 8 Experimental and exhibitory building in Prijakovci, Banja Luka, Bosnia and Herzegovina. Picture displays general structure and combination of load bearing wall and timber frame - before completion with glazing on the southern façade (image by author).

The building plan is comprised of two semi-ellipses (with outer perimeter axes of 9 and 4,5 meters). Foundations of compacted river-gravel support stem wall constructed of stone laid in lime mortar. Load bearing walls (one curvilinear continuous wall) include cob (in ratios of sand to clay soil of 3:1 and triticale straw 'to taste' [60] and cob combined with straw-bales ('bale-cob' [61]). Smaller infill elements were constructed in technique of light clay straw [62] and sand-clay-straw renders include 1/3 cow dung. Southern wall (completely glazed) employs a round-wood timber frame made of spruce (*Picea abies*) and protected with pine-tar. Extensive green roof (with mostly *Sedum* and *Sempervivum* species currently establishing in 5 cm of local soil) rests on low-cost (although robust) HDPE membrane.

Being oriented towards true south, having glazing angle defined in relation to angle of winter sun and by utilizing both thermal mass and insulation the building refers to principles of passive solar design. Additional heating is provided by low-tech wood burning device known under its open-source name 'rocket mass heater' [63]. The building is located in Prijakovci (vicinity of Banja Luka, Republic of Srpska, Bosnia and Herzegovina) and its intended use consists of plant nursery and winter gardening – with, obviously, complete and accentuated light penetration almost exclusively from south, southeast and southwest.

During the building process, which included minimum of mechanized work, relied heavily on personal effort and non-specialized labour (with notable exception of timber frame construction), several themes have been put forth:

Theme of overall environmental impact: One of the common habits of natural building movement is edification of exhibitory buildings which thereafter often employ low regime of use (examples being community buildings or guest houses). The assessment of environmental costs of building construction relative to benefits of promotion of environmentally and socially conscious practices is becomes additionally complex if exhibitory building becomes a vehicle of primary (photosynthetic) production. Thus locally produced food (even out of growing season) increases general benefits.

Use of locally sourced materials: As previously discussed, finding and gathering of materials out of immediate surrounding is regarded as simultaneously environmental, esthetic and existential practice. The building process described here, initially had felicitous prospects in such approach: seasonal creek in distance of 10 meters, abandoned small local quarry in distance of less than 150m (being previously the source for foundations stone for many older local houses), significant volume of soil excavated for foundations. All this coincided with local reconstruction of electrical distribution network which included replacement of chestnut pillars (of adequate size) with concrete ones.

However, the contexts of available energy (based in voluntary manual work of family members and friends) made gravel in creek bed unavailable and ordered for purchase of commercial mason's sand. Contexts of both available energy and specific techniques also made unavailable the stone from the local quarry; discarded stone from excavation operations (in distance of 7km) was obtained. Alluvial soil excavated on the building site had practically nonexistent fraction of clay and could not be used for construction purposes; clay from block brick factory (7 km distance) was used. Chestnut poles, instead of being directed for disposal, were considered valuable resource in local villages and thus hard to obtain in sufficient quantity; adequate technical wood needed to be sourced from distance of 50 km.

Described array of contextual forces presented a theme of adequate *infrastructure* which would, paradoxically, enable sought after spontaneity of natural building. Such infrastructure (on multiple levels) could probably be explored in relations of broad grassroots *culture* and particular cases and contexts.

8. CONCLUSIONS

In the same way that 'life quickly occupies any niche it can exist in', cultural (and architectural) worldviews promptly form inside newly emergent cracks, gaps and sometimes vast wastelands of total cultural landscape. The constantly melting faith in endless powers of 'Progress' and (in somewhat lower key) constantly melting confidence in 'endless possibilities' enabled by (post)industrialism and its markets - coupled with environmental damages caused by both – led to articulation of building practices that re-positioned *dwelling* (in full Heideggerian sense) as integral and integrated relation to world.

Gradual amalgamation of these separate and technically diverse efforts drew contours of an informal and heterogeneous movement, with its matched body if literature, periodical assemblies, crossing and hybridization of technical practices, as well as distillation of general, common but still informal principles.

Several distinct schools of natural building had formed its articulate systems of architecture around technology, ethics, relation to context, form (and esthetic experience in general), political orientation and lifestyle.

The basic characteristics of these schools stem form a certain regression of construction specializations. Form and use of space are not designated in any sort of ideally completed building design; the design process merges into building process. The building process itself is not a mere technical procedure of converting designed into built, nor is it just a machine or human labour. Materials should not be inert means to construction of walls or foundations, but animate exponents of place to be inhabited; they are (ideally) not produced and purchased, but *found*. Additionally, 'authorship' becomes dispersed through various individuals, groups and independent processes – processes of designing, building, inhabiting and gradual decay (and renewal). Eventually, boundaries of broader categories of architectural, ontological, ethical and esthetical become blurred and even non-relevant.

The end result in immediate formal sense is often modest, albeit suggestive regarding potentialities. However, previously described processes (opposite to specialization and fragmentation) broaden the total field of esthetic experience. Thus completed architectural forms are not of greater importance than for example a moment of discovery of adequate building soil or a play that surrounds kneading of soil, sand and straw or a relation made with a tree that has not been cut – or with one that has, when that was needed.

The use of materials is an instrument for establishing proper and deepened relation with (natural) world – endangered to the point in which abstention of any construction work may be regarded as the only truly ethical act. Materials, ways in which materials have been utilized, as well dominant form of human relations, define a position that questions or explicitly refuses to participate in economic and social activities that dilapidate integrity of both societies and ecologies.

Further potentials of this dispersed movement lies in provision of ways for return of building practices into human and ecological communities after demise of almost endless availability of resources and energy. The ultimate significance of natural building resides in full recognition of architecture as medium of lived experience.

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PRIRODNO GRAĐENJE: KONCEPTUALNI NARATIVI, EKOLOŠKI OBZIRI, DRUŠTVENE SVRHE I SUBJEKTIVNI ISHODI

Arhitektura materijala kolokvijalno nazivanih „prirodnim", u okviru opšte scene ekološke arhitekture, predstavlja jednu od grana sa posebnim stepenom konceptualne autonomnosti i upečatljivim vizuelnim identitetom. Ipak, rijetko se ispituje specifični karakter ove arhitekture, kao što se rijetko provjerava i široki, dosljedni i istrajni pristup koji ju oblikuje. Ovo istraživanje određuje najšire konceptualne, društvene i političke pozicije neformalnog pokreta „prirodnog građenja". Provjeravaju se uslovi u kojima su te pozicije formirane, kao i razlozi za njihovo ignorisanje u okvirima dominantnih arhitektonskih diskursa. Posebno se ispituju kulturno i geografsko porijeklo (sjeverozapadna obala Sjeverne Amerike i visoke aridne oblasti kontinentalnog jugozapada istog kontinenta), zatim integracija etičkog, estetskog i življenog, te, konačno, transformacija specijalizacije, autorstva i podjele rada. U završnom dijelu rada, ukupni raspon ispitivanog fenomena istražuje se i ilustruje kroz dva specifična arhitektonska pristupa - oregonski kob (Oregon Cob)i ertšip (Earthship) – kao i kroz autorovu ličnu uključenost u navedeni pokret preko projektovanja i građenja manjeg eksperimantalnog objekta u Bosni i Hercegovini.

Ključne reči: *prirodno, građenje, reciklirano, kob (cob), earthship*