

TRANSPORT DESIGN FOR EXTREME ENVIRONMENT: METHODOLOGICAL EXPLORATION (with Reference to Polar Regions)

Extreme environment or *extreme case* is an aggregate of circumstances which exceed the limits of the common and create serious difficulties for vital activities or render them impossible [12]. The key features of the extreme environment are the lack of alternatives, absolute maximum of tension, synergy in the cooperation of negative factors, etc. In this case, all antagonisms related to the 'tangible world' ('world of artefacts', i.e. material environment) become especially apparent. Moreover, the extreme conditions are a specific (and the most objective) filter which lets through only things irreproachable in the performance of their *functions*. Here is a typical example – a war where everything is absolutely functional: machinery, equipment and, of course, user behaviour. In everyday life, we can find a similar situation in the work of rescuers. Where technical characteristics are of decisive importance, where a man's life depends on computational accuracy – is there a place for the lyricism of the *image* provided by design? Do we really need a special 'design for extreme environment'? The answer (and, simultaneously, the basic prerequisite of the research) is affirmative: undoubtedly, we need it because it is exactly in extreme conditions that the *image* transforms from an *aesthetical* category (optional) into a

functional one (mandatory).

INTRODUCTION

Discussions about the essence of design as a phenomenon keep emerging over and over again. This indicates the stage of "prescience, which lacks a central paradigm" (Kuhn, T., 2003) in the professional community. The scale of this phenomenon (no less!) could be grasped only through transiting beyond practice and looking at *design* as an activity, science and world-view all in one. According to Mike Press and Rachel Cooper, the complication with comprehensive examination of design is that it «constantly evolves, expands the range of its objectives, changes the organisational forms, goals and functions of the product of its activity. Therefore any postfactum descriptions automatically lag behind reality...» (Press, M. & Cooper, R., 2007).

A clear consequence of this controversy and misreading inside the community is a 'blurred' (undefined) positioning of design outside. If practicalities of design should serve industries, then the research potential of design raises some problems. And the main of them is the problem of choice: leading or following? (Friedman, K. 2003). In other words, does the sphere of design studies possess its own scientific autonomy (first and foremost, any forecasting value), or is its aim only to produce theoretical reflections of practical experiences and to be a tool-maker for practice? Accepting the 'left' (first and radical) point of view lays a claim to the leadership of design studies and needs to be proved by case study.

In this paper, the forecasting possibilities of design and the fact of growth in professional knowledge is shown using an example of concrete applied research with the aim to develop a methodological concept of transport vehicle design for the extreme Arctic environment. This research is now in process, therefore the results are presented only as a proposal.

The problem domain addressed for the exploration

The rapid development of sciences and technologies enables human to active exploration of areas, which have been inaccessible before: first and foremost, territories with environmental extremes, i.e. interplanetary (Moon and Mars missions, etc.) and terrestrial (underwater, polar, etc.). But the reality is always more complicated than laboratory test-beds, i.e. the behaviour of those environments unpredictably differs from computer-based simulation and the total control is unachievable.

Therefore, the exploration per se is now an aggregate of “blind” actions: when we face the need to survive in an unexplored extreme environment we still decide this issue by trial and errors. Obviously, the price for such a careless approach may be too high. The problem is how to *live* instead of *survive*.

In Arctic Case Study, i.e. in the situation of a narrow-focused commercial development of natural resources, we inevitably lost an alternative (non-profit) value, i.e. the *habitability* of the “Arctic Planet”. Its chronicles already contain the experience of successful adaptation to environmental extremes. The indigenous peoples have inhabited the land for many centuries; and now they are a living proof of comfortable existence in harsh natural settings. Such a long period of their existence indicates the inclusive fitness: from an individual’s physiology to a common social structure, from one mindset to whole material environment.

Artifacts indeed are the real evidence of the harmony of indigenous lifestyle (acc. to Golovnev, A.V.). It was pretty lost in the most circumpolar countries, but still exists in its primordial form in the Russian Arctic, e.g. Western Siberia and Yamal Peninsula.

The number and the list of an Arctic nomad’s artifacts are strictly determined and “polished” by the evolution. The indigenous material environment as a single whole presents an embodiment of the expression “indeed, people need no things, but their functions” (Altshuller, G. S., 1979).

Meanwhile every nomad’s artifact is of eco-friendly origin: it emerges from nature and disappears in nature completely, when it reaches the end of its service life. And beyond these characteristics every thing is full of *life*, i.e. gifted with the *soul* during the making; therefore it is human-kindred “by default”(acc. to Garin, N.P., 1991).

This close relationship as an integral feature of

perfect design, which we are just starting to grasp, has been already achieved many centuries ago by another culture and continues living in the close neighbourhood, i.e. at the common territory of the Arctic. We can get benefit from it through examining that culture (material layer) with the purpose to apply to our case. It may be considered as a real professional challenge for designers, i.e. an opportunity to achieve the “ideal thing” in the context of our polycultural reality. Designers are able to carry out the cross-cultural “translation”: to re-think the native artifacts as “material evidences” of adaptation and extract their distinctive features for subsequent interpretation and creation of products well-suited to us as ‘newcomers’. Ultimately, this is a proposal to transform the way of developing a “New Culture”: from artifacts to human internal fundamentals.

In terms of design process it means that the borrowing from the indigenous culture should be undertaken on the level of intangible images, instead of tangible surfaces.

For the case study of the research it is suggested to examine the most problem sector of artificial environment (technosphere), i.e. transport. In the case of extreme environment transport becomes a “lifestyle basis”: the way and the means by we can get to a hard-to-reach territory will determine our future lifestyle.

Questions for research

In terms of systems approach any environment with rigours natural settings (Polar Regions, Underwater, Space, etc.) may be presented as a ‘loop system’ *Man – Technology – Extremes*. There every element is linked to each other through a *negative feedback* impossible to be broken from within. The above-mentioned intersystem contradiction (*Man* relies on *Technology*, which vulnerability increased dramatically in *Extreme Conditions*) leads to a range of professional issues need to be investigated:

- What the Technology for the extreme environment would like? and
- How to design (create) this particular kind of Technology (Transport), i.e. *Extremal Transport*?

The research goal

To develop a methodology for creating Polar technosphere as a testbed for exploration of extreme environments (more specifically, on the level of creating the images of transport vehicles).

General research hypothesis is that in extreme environment all machines have to be “animated” to function closely together with people. They must

be designed so that they are experienced as a prolongation of the body and mind. And this result can only be reached by work with the conceptual images based on metaphors (acc. to Bradie, M., Casakin, H. P., Coyne, R.).

Methodology

It is envisaged the research will be based on the post-nonclassical methodology, i.e. *synergetics* as an evolutionary stage of the general systems theory. In the particular case of the design study it is proposed to use a special kind of the common methodology, i.e. *synergetics of creativity* (Kagan, Koblyakov, etc.). The exploratory field of this methodology includes the principles of self-organization of artificial systems interacting with a user in extreme environment.

The essence of synergetics is the methodological mechanism of transforming undeniable subjectivity to objectivity (Kagan, M.S., Koblyakov, A., Makhlina, S. T.). In the case of “design synergetics” it means spontaneity based on an individual aesthetic experience, raised to a rule. In terms of synergetics, the *artistic image* is nothing but a result of *synergistic effect*, i.e. “cooperative effect” (Goubin, V., 2004). Hence, the irrational mechanism of artistic thinking turns into a scientific standard for design methodology.

The synergetic basis gives us an operational freedom in choosing and combining different methods and approaches. The study is planned to consist of several stages, each one of those requires special mind operations. The empirical stage (gathering data) will be steered by the methods as follows:

- **literature review** (hand-search of published literature and electronic databases for gathering secondary data);
- **analysis of analogs and prototypes** (such as samples of Space, marine, Polar and other kinds of technology for extreme environment) as well as specific design methods and principles;
- **immersion method** (ethnographical method of field studies) will supply the first-hand data through interviews, surveys, observations, etc. during the expeditions.

The development process of the algorithm of synthesizing the design image of transport for extreme environment would be supplied by the following approaches:

- **regional approach** (to bind together universal aspects and thoughts of design with climatic and socio-cultural context of existence of further vehicles)
- **metaphorical approach** (to establish as

well as verify the primary importance to *creativity*. It means that we inevitably come to another interpretation of the design process: as a mystical act performed inside the mind of a separate designer (already artist). It is a typical description of “black box” design (acc. to Jones). Applied to “design for extreme environment”, the synergistic basis enables one to remove the internal tension of the “eternal contradiction” between *beauty* and *utility*. How? – by transferring the mechanism of evaluation from the field of rational criteria to the field of emotional experiences. That is what D. Fallman calls “romantic design” (Fallman, D., 2003), i.e. the shift from *method* (as a scientific constant) to *metaphor* (acc. to Coyne, R.))

Preliminary research outcomes

A conceptual basis for a ‘design for extreme environment’ is intended to be developed. It would include the following:

- 1) a new definition of a Man-Machine interaction in extreme environment (emotional relationship instead of instrumental collaboration);
- 2) a range of characteristics of a ‘design etalon’ of material culture for extreme (borrowing from the Arctic indigenous peoples);
- 3) a methodological priority of the artistic image for creating transport vehicles for extreme environment;
- 4) an experimental algorithm of developing the image of the vehicle for Polar Regions (in context of a comprehensive project “A Sustainable Mobile Settlement on the Permafrost (Permafrost SMS)” intended to develop in collaboration with architects and natural scientists)).

Anticipated Contribution to Knowledge

- 1) The research would form a ground for a new sector of design theory and practice, i.e. ‘Design for extreme environment’;
- 2) the conceptual framework for interdisciplinary collaboration in developing a “New Extreme Lifestyle” (particularly for Polar Regions) would be suggested (e.g. between natural, social and art sciences in the case study ‘Permafrost SMS’).

Several avenues of the future development of the research

- 1) Expansion of the area under study (e.g. from Arctic to Space);
- 2) methodological reflection (e.g. preparing an educational programme (*or* curriculum) “Design for Extreme Environments”).

References:

In English:

Bradie, M., 1999, 'Science and Metaphor'. In: *Biology and Philosophy* 14.

Casakin, H. P., 2007, 'Metaphors in Design Problem Solving: Implications for Creativity', In 'International Journal of Design'
<http://www.ijdesign.org/ojs/index.php/IJDesign/article/view/53/27>

Coyne, R. 1995, 'Designing Information Technology in the Postmodern Age: From Method to Metaphor', Cambridge, Mass.: MIT Press.

Fallman, D., 2003, 'In Romance with the Materials of Mobile Interaction (a phenomenological approach to the design of mobile information technology)', Umeå, larsson & co:s TRYCKERI AB.

Friedman, K. 2003, 'New Design Research: Leading or Following?'
<http://www.nextd.org/02/01/02/index.html>

In Russian:

Altshuller G.S., 1979, 'Creativity As an Exact Science. Theory of Inventive Problems Solving', Moscow, Sovetskoye Radio.

Garin, N.P., 1991, 'Borrowing from native culture as a design technique'. Unpublished candidate dissertation, Stroganovky University, Moscow.

Golovnyov, A. V., 1995, 'Talking cultures: Samoyed and Ugrian traditions'. Yekaterinburg: UrO RAN

Goubin, V. B. 2004, 'Towards a Methodology of a False Science', Moscow: PAIMS

Jones, J. C., 1986 (Russian Edition), 'Design Methods', Moscow: MIR.

Kuhn, T.S., 2003 (Russian Edition), 'The Structure of Scientific Revolutions', Moscow: AST.

Kagan, M. S., 1999, 'Aesthetic & Synergetic', in 'Aesthetic Today: Current State and Perspectives of Development' (collection of research articles), SPb: SPbPhO.

Koblyakov, A. 2002, 'Synergetic & Creativity: a Universal Model of Removal Contradictions',
<http://spkurdyumov.narod.ru/Koblyakov/Sasha1.htm>

Makhlina, S. T., 2004, 'Towards the Synergetic Analysis of Art Works'
http://anthropology.ru/ru/texts/makhlina/symp12_64.html

Press, M. & Cooper, R., 2007 (Russian Edition), 'The Design Experience: The Role of Design and Designers in the Twenty-first Century', Misk: Grevtsov Publisher.

Sidorenko, V. et al., 1969, 'Design Methodology', Moscow: VNIITE