

Exploring Environmental Dimensions: On Sustainability as an Architectural Problem; Why It Is Not Enough To Discuss Space and Time Only

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My research aims to explore how architecture responds to environmental input. It claims that this to a large degree is done today by “add-on” technology, e.g. sound environment is modified with specialized dampening materials, and climatic issues are addressed with increasingly complex and energy consuming ventilation systems. The conceptual and/or artistic architectural expressions are often not approaching those aspects in direct consideration (except i.e. project "Morpho-Ecologies", Responsive or Performative Architectures). As a critique of this division of environmental criteria from the architectural overall performance the research seeks to demonstrate and systematize an integral approach where the environmental responses are met with material systems that also form new architectural spaces and forms. The synergy of interdisciplinary architectural research and criticism is crucial to this project which hopes to motivate and perhaps inspire practice as well as the public.

“It was also troubling that most of the daily press covered the Ground Zero story in bits and pieces, with someone writing about the politics and someone else about the money and someone else about the architecture, as if you could really separate any of these things.”
(Goldberger 2003)

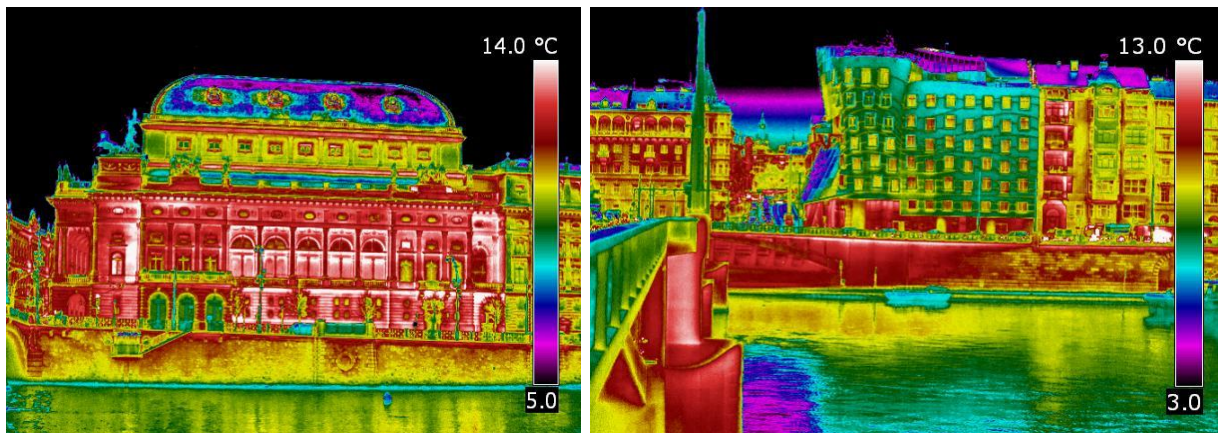
When Vitruvius writes on “The Education of The Architect” he is suggesting rather complex interdisciplinary overview of knowledge (drawing, geometry, history, philosophy, music, medicine, etc.) and communication, informed by both practice and theory. The question on “What is architecture” remains unanswered though continuously challenged. Among all the other criteria, I think there should be paid particular attention to the problem of interaction of different forces (or “interactors”) involved, resulting over time in space.

Space, and later on time, probably in connection with the established representational design tools such as physical and digital models, have become frequently discussed topics in architecture. These together with “interactors” such as sound, light, weather conditions or even human activity (incl. politics, economy, society, individuals, etc.), form the architectural environment. This is why I refer to them as environmental dimensions. Environmental dimensions are primary energy resources. I.e. [Theo Jansen's walking sculptures](#) don't require any electricity, they use wind energy directly. When discussing environment or sustainability it is interesting to note, that these notions seems to be understood by architects mostly as a technical problem which is most often solved through incorporating technically sustainable elements into architectural design. As opposed to that, my contribution is to be from the heart of my profession: I will discuss the environment and sustainability questions as architectural problems (*means interdisciplinary informed*).

My project is to research such environmental dimensions through both practical experiments as well as theoretical reflections, including examinations of other scientific and artistic disciplines to develop a strong background for architectural practice. The research method is composed of literature review, experimentation and reflection. The experimental part, “first-person practitioner research”, is necessary to demonstrate and visualize the possible alternatives to the traditional approach. Such a method has been used and explained by Birger Sevaldson in his PhD thesis:

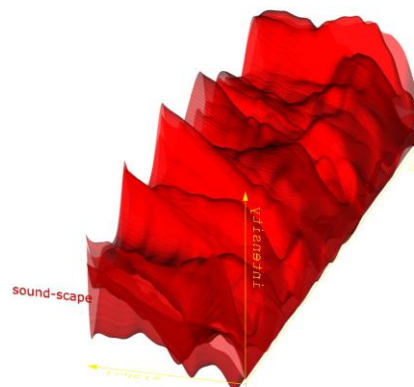
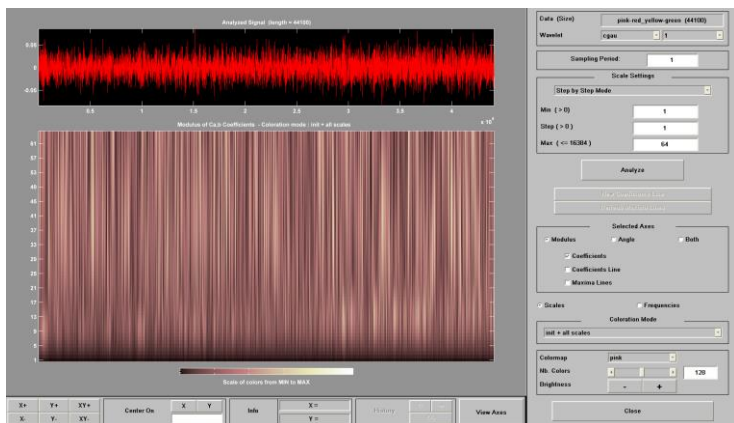
“In creative emergent design practice which is now becoming necessary for designing with digital tools, practitioner researchers find themselves in situations in which clear models and methodologies do not yet exist – these are being developed through practice.”
(Sevaldson 2005)

The ambition is to analyze, define and develop possible strategies for interacting with site specific key environmental dimensions by creative design where those are the primary resources. The method is into large degree “research by design” where hands on experiments, interdisciplinary networking and consultancy are crucial. It includes site specific driven analysis of environment, it's natural or existing (different types of pollution such as noise or heat, etc.) resources with using different types of registering and evaluation methods, i.e.: thermo-cam, recording (audio, video, radio, etc); MATLAB (Matrix Laboratory), Rhino 4.0 Lab tools; as well as analysis and comparative studies of contemporary and local traditional/vernacular architectures and urban settings. Particular attention is paid to ongoing environmental research in complexity, performative architecture, material systems and parametric design. Diagramming is used as a tool for understanding and presenting the problematic.



To the left: Thermovision image of Prague National Theater shows the heat radiating from the stone wall. To insulate this building would have destructive consequences to the building, both, it's indoor climate as well as it's identity. Instead, the roof of the building hosts large solar power station. In cases like this one, the approach seems to be relevant.

To the right: The thermovision image of “Dancing House” in Prague shows that the building is relatively well insulated and does not radiate much of the heat. According to architect Jan Smola, this building hasn't been designed with any special intention to be “ecological”. The reason for it's efficiency is in high quality level of building production, pointing to the fact that the large insurance company was building the house for it self. (Smola 2009)



To the left: wavelet analysis made in MatLab of noise recording in Oslo city environment . The sample shows simple repetitive pattern of the sound source in environment. (Davidova 2006)

To the right: 3D diagram of sound-scape generated in Rhino3D from wavelet analysis of recordings taken on site in the same time with microphones of different recording abilities and directions (Davidova 2006)

Neither true design of architecture, nor research of it's strategies can be developed purely from the office desk without ongoing confrontation with site specific settings. This particularly applies to “research by design” method. My research is to experiment with small scale thematic site specific installation projects, all the time informed by theoretical questions/inputs. This exploratory, generative approach to the research has its aim in both, to broaden public and practice oriented professionals discussion on the topic as well as to create strong, empirical ground to architecture.

Why it is not enough to discuss space and time only.

It is difficult to imagine space which is, for instance, traditionally defined by three dimensions x,y,z, but there is no light there making possible to see anything (and perhaps there is also nothing to see either), there is no heat you could feel, nothing to hear, no smell, etc. It is as difficult to imagine, that this space is happening in time. From the architectural view, the word environment¹ could be defined as space which is enriched by interaction. We could say that the space as such does not exist in time and that the space-time dimension is defined by interaction. The space-time with interactors then forms the environment. To design in relation with light, sound, wind, weather or stars position, politics, etc. has been common throughout the architectural history², whether in symbolic, metaphysical, pragmatic, phenomenological or other manner. These factors are important dimensions of the environment.

Unfortunately it is difficult to find enough evidence³ that contemporary architectural practice pay much attention to this problem in its complexity. Unless there is a particularly extreme condition (i.e. wind question in Holmenkollen ski jump competition), those factors are rarely questioned, or they are implemented locally as 'a piece of art' or other additional, often digital devices. In general, it appears to be perceived as single oriented technical task, rather than a problem, offering possibility of an architectural solution in depth. For example in practice, the usual solution to noise problem of a given site is sound insulation of the designed building interior, rather than a wider consideration of noise in given environment; the locally placed art pieces⁴ calculated from the building budgets of public buildings often don't refer neither to the architectural environment, space or even form nor to the public. More complex solutions for urban environment in applied building design (or building industry?) seem to be underrated in spite of criticism coming from related disciplines.

i.e.: When Zygmunt Bauman criticize public city space and questions the example of La Defense for not being 'civil', he discusses the impossibility of civil interaction in inhospitable modernist public space where the inaccessible, authoritative buildings with facades made of reflexive glass are not opening them self into the public space, are meant to look at, not in (Bauman 2000), he talks from his sociological perspective about exactly the same phenomena as sound ecologist Barry Truax from the view of his profession. Truax writes:

"The so called 'canyon effect' is a striking example of how the highly reflective materials used in tall buildings and their symmetrical placement in long corridors, creates an acoustic situation where all sounds are "trapped" through multiple reflection. The result is a "diffuse sound field" of such uniformly high ambient level that a lo-fi situation is immediately created, and only the most powerful sound signals can rise above noise. The effect on the listener is a kind of aural claustrophobia." (Truax 2001)

From the architectural theory critique position, the problem of the relationship between structure and skin focusing in "architectural surface" is well analyzed by David Leatherbarrow and Mohsen Mostafavi (2002) in publication "Surface Architecture". Arguing that the properties of a building's surface are not merely superficial; they construct the spatial effects by which architecture communicates to its environment, declaring both its autonomy and its participation in its surroundings. Contemporary research in material systems is opening new options to this performance. It is architects who are into large degree generating those environments by their design, the problem should be addressed by the architectural field. It seems like the general approach to contemporary architecture is often stuck in modernist aesthetic formalism as well as methodological dogmatism like "problem solving", which does not allow complex solutions. There is increasing evidence of interest in sustainable architecture, but I must agree with the two recent writers on the environmental aspects of architecture, Joo-Hwa Bay and Boon Lay Ong:

"A common perception is that sustainable environments are not 'visible', and 'trendy architecture' with seemingly sustainable features can fail badly and not work ecologically." (Bay & Ong 2006).

This interest often boils down to a commercial strategy rather than a truly sustainable environment and popular architectures are applying visual representations as false symbols of sustainable features.

¹ Environment is physical and biological surroundings of an organism. The environment covers non-living (abiotic) factors such as temperature, soil, atmosphere and radiation, and also living (biotic) organisms such as plants, microorganisms and animals. The study of the relationship of organisms to their environment is called ecology, and protecting the environment involves conservation.
(© World Encyclopedia 2005, originally published by Oxford University Press 2005)

² i.e. Stonehenge, obelisks, pyramids, west side-east side city planning, cathedrals, work of Le Corbusier and Steven Holl, or Jean Nouvel's L'Institut du Monde Arabe, etc.

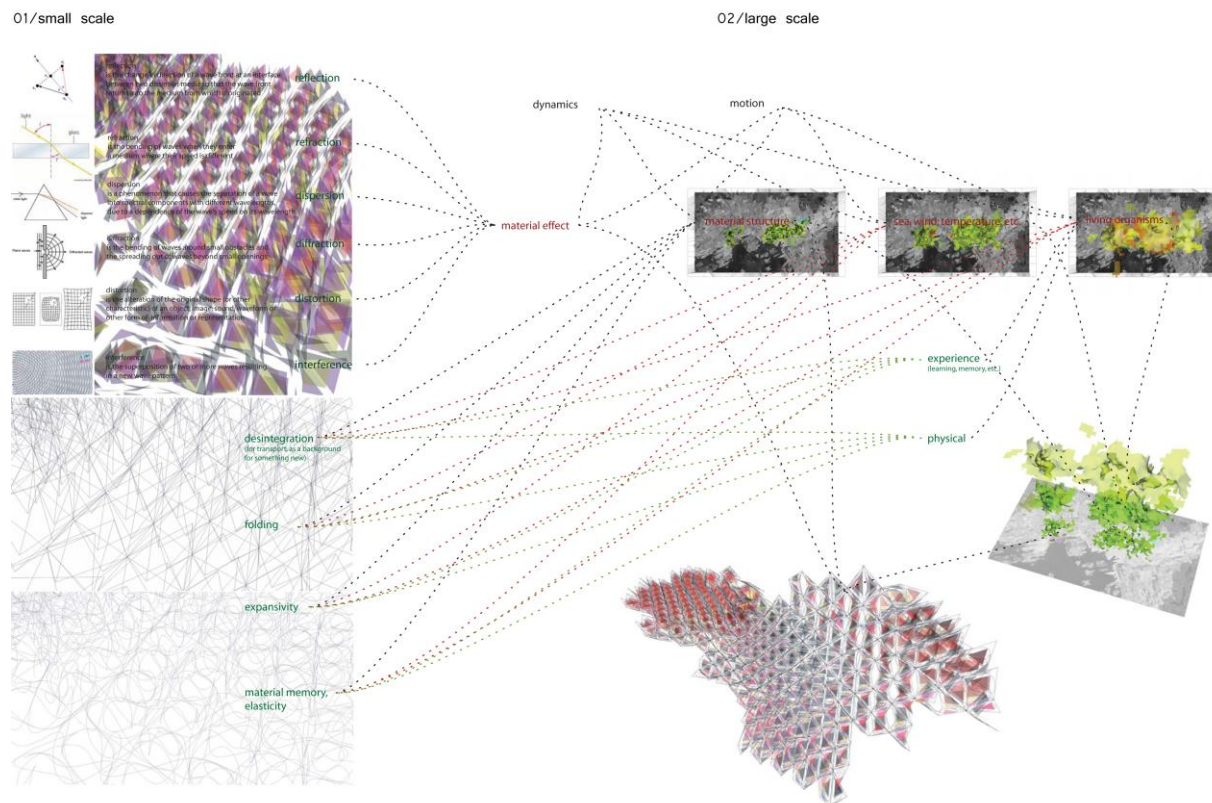
³ except already mentioned examples: project "Morpho-Ecologies", Responsive or Performative Architectures

⁴ the very good exception here is Arne Norheim's sound installation Bekkelaget sewage plant in Oslo

The pressure from the architectural critics side on the commercial sector is almost non existing possibly for similar reason as the failure of the architects. The lack of interdisciplinary cooperation and “hands on” experimentation disable them to rise critical questions. In the still ongoing visual culture, where image (the visual representation) has symbolic understanding of its features, the critics by exhibiting physical performance experience is lacking. Other professions than construction or interior acoustic engineers are usually not included in architects project’s budget. The tools addressing the problem, such as computer software, are as a rule not designed for architects. The formal architectural design tools are split into particular kinds of representations, such as models, or drawings, or particular computer simulations. Scientific publications are subdivided into their specification fields not really enabling to examine the complex environments we are creating. Today emerging “Building Information Modeling” (BIM) which enables more interdisciplinary cooperative environment seems to address the question but still not fully answering either. i.e: The socio-political and cultural aspects except economical sustainability are often excluded from such processes. Low attention to local site specific dimensions is often paid in parametric design. More integral approach to environmental design is necessary.

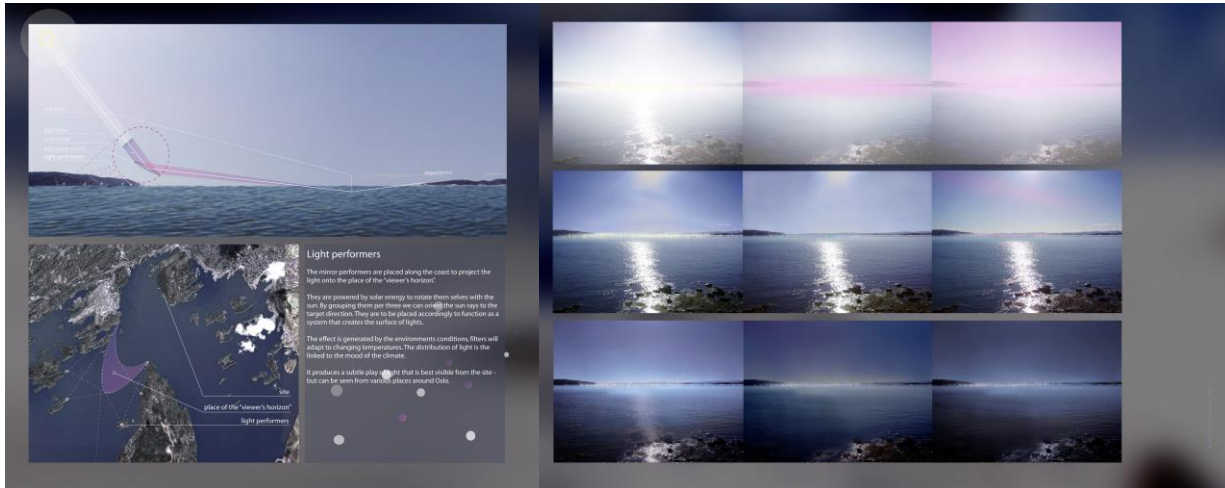
Examples of my work related to this topic:

HOLOSLO - The penetrating of latent (Davidová 2007)



HOLOSLO - The penetrating of latent is a city environmental installation that generates complex, non repetitive output from environmental input “waterfall sound from motorway”. It's main topic is variosity of sound and visual information condition in Oslo as well as radio signal intensity. The installation moves by interaction of material and temperature (shape memory alloys or bi-metal) while the two layers of acrylic surfaces interact (reflect, distort, refract, etc.) with the sound and light input. The metal structure is system of antennas. The system operates as such: There is the “folded moving structure” from the picture on the model on previous page. To this system is anchored a system of shape memory alloys (possibly bi-metal) which operates the motion of the first one. The system of moving structure operates inner and facet structures of reflective acrylic surfaces that are attached to it. The inner system of surfaces, are parabolic shaped, so the input source (sound and light) is distorted and extended. Both the systems of the reflective acrylic surfaces communicate to each other via reflections and transitions. The facet reflective acrylic surfaces are flat. The acrylic surfaces extend the heath to operate the shape memory alloys that operates the “folded moving structure”. Thanks to the complexity, this material system based structure, in fact based on simple feedback loops, it is dynamic.

To Reflect Transitions - Memorial Site in Norway for The Victims of The Tsunami Disaster Dec 26th 2004
(Davidová, Stenman and Žikovský 2006)



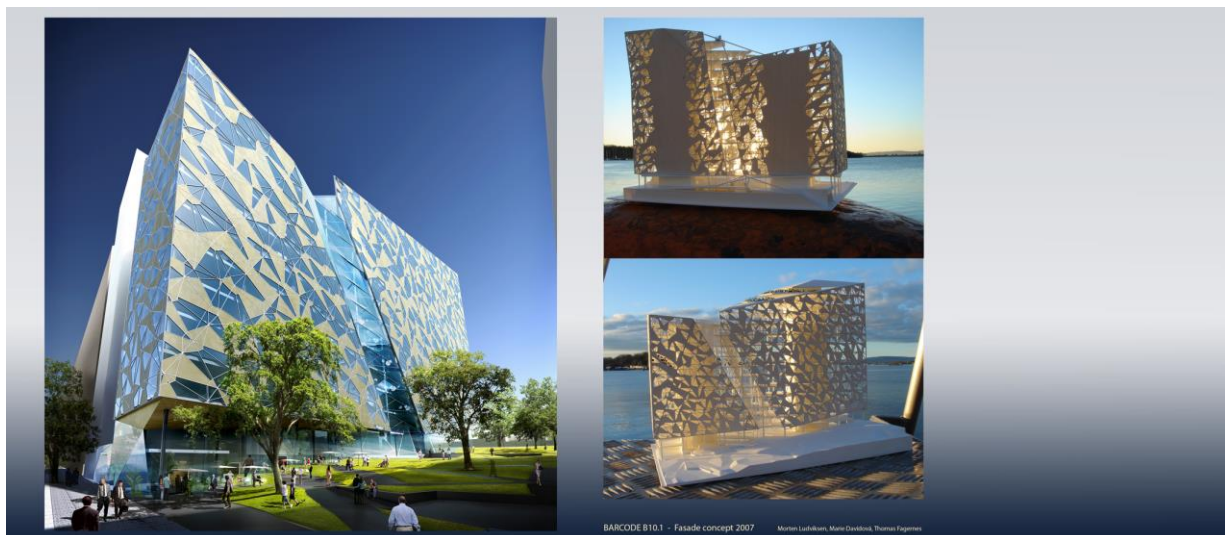
Project “To Reflect Transitions” is purely abstract and ambiguous in its content.

We have considered the site’s environment melancholic and beautiful in its nature. Therefore our ambition is to intensify the emotional perception by the already existing rather than to suggest radical landscape interventions or the use of signs. We seek to attract the mind in an almost subliminal level: “something that has happened behind the ocean that we can not fully grasp but has strongly effected the lives of many of us”. Through intensifying emotional perception we wish to support harmony in souls of the people who have difficult emotional memories. Experiencing the landscape and thinking of the ones they loved or processing their own personal experience should equalize the memories in their mind. The soothing view to the horizon, the rippling lights on the sea surface, motion and sound of the waves and wind in the landscape, the sky, the whole environment, will generate a new emotional layer, the one of infinite eurhythmics.

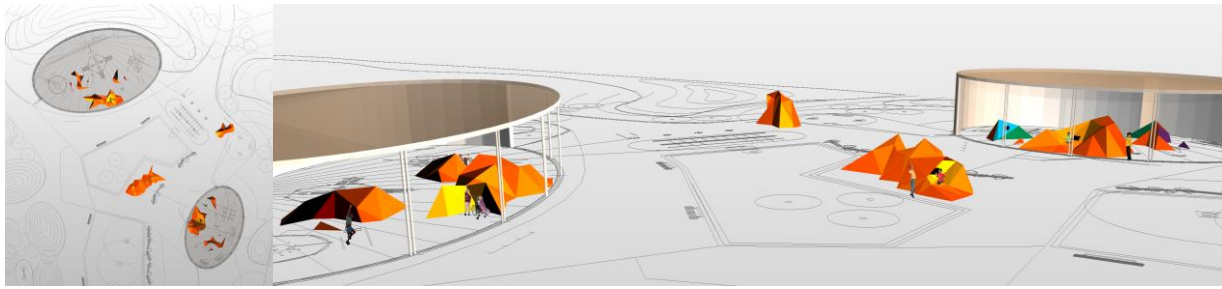
The project connects the chosen place with the ones of disaster just by viewing the horizon (through sun/moon and ocean). We proposed to reflect the sun/moon on the sea waves in order to intensify the view of the ungraspable horizon while connecting the places in space as well as to bring spreading sparks of light into the eyes of distressed people. In the same way as the human reflection of memory is not static and it changes over time, our proposal aims to be part of the environment. Changing conditions of the season, weather, day or hour make the installation react.

The mirror performers are placed along the coast to project the light onto the place of the “viewer’s horizon”. They are powered by solar energy to rotate them selves with the sun. By grouping them per three we can orient the sun rays to the target direction. They are to be placed accordingly to function as a system that creates the surface of lights. The effect is generated by the environments conditions, filters will adapt to changing temperatures. The distribution of light is the linked to the mood of the climate.

BARCODE B10.1 - Fasade Concept Development (Snohetta AS; Morten Ludviksen, Marie Davidová and Thomas Fagernes 2007)



On the BARCODE B10.1 facade concept development we were testing different types and scales of pattern and perforations of materials. The diversity of the material properties as well as irregularity of the pattern should lower canyon effect given by the urban settings and support light and general visual diversity of both interior as well as exterior.



The task was to create covers and stands for touch screens and other digital devices for children energy resources exhibition game. It was also important that the children in age from 6 to 13 years and disabled on wheelchair can comfortably reach the screens and web cameras. Instead of accepting singular function with machinery to adjust the devices according to individual child the design aims to generate architectural space as well as to be full part of the exhibition. In the same way as the energy resources are based in landscape environment placing of triangulated “landscapes” between different energy resource exhibits develops spatial understanding of the exposition and in the same time unites it as a „land mark“.

Children can check in to the game by “climbing” on the “landscapes” to the touch screen or use handicapped access. There is one check in for climbing which is accessible for disabled on the wheelchair, one steeper and one direct from the floor. Other interaction points are placed in different “caves” and “landscapes walls”.

The solution covers variety of choices for interacting children with different needs and preferences and creates complex spatial, acoustic, visual and weather environment.

Literature:

- Vitruvius, translated: Morgan, M.H. (1914). "The Ten Books on Architecture", Cambridge: Harvard University Press. London: Humphrey Milford. Oxford University Press. ISBN 1-4212-7011-0
- Eliasson, O. (2005) "Your Engagement has Consequences", Lars Muller Publishers, Malmo, Rotterdam, Tokio. ISBN-10: 3037780754
- Jansen, T. (2007) "The Great Pretender", 010 publishers, Rotterdam.
- Pallasmaa, J. (2005) "The Eyes of the Skin", Wiley Academy, West Sussex. SBN-10: 0470015780
- Sevaldson, B. (2005) "Developing Digital Design Techniques: Investigation on Creative Computing", AHO, Oslo.
- Mostafavi, M.; Leatherbarrow, D. (2002). "Surface Architecture", MIT Press. ISBN-10: 0262134071
- Hensel, M. and Menges, A. (2006) "Morpho-Ecologies", AA, London. BN-10: 190290253X
- Castle, H. ed. (2006) "AD, Collective Intelligence in Design", Willey Academy, London.
- Prestinzenza Puglisi, L. ed. (2009) "AD, Theoretical Melt Down", Willey Academy, London.
- Garber, R. ed. (2009) "AD, Closing the Gap: Information Models in Contemporary Design Practice", Willey Academy, London.
- Lally, S. ed. (2009) "AD, Energies: New Material Boundaries", Willey Academy, London.
- Kolarevic, B. (2005) "Performative Architecture: Beyond Instrumentality", Spon Publishing, New York. ISBN-10: 0415700833
- Kronenburg, R. (2007) "Flexible: Architecture that Responds to Change", Laurence King Publ., London. ISBN-10: 1856694615
- Beesley, P.; Hirose, S.; Ruxton, J.; Trankle, M.; Turner, C. (2006) "Responsive Architectures : Subtle Technologies", Riverside Architectural Press, Toronto. ISBN-10: 0978097807
- Zumthor, P. "Atmospheres: Architectural Environments - Surrounding Objects" (Hardcover). ISBN-10: 3764374950
- Bay, J.H. and Ong, B.L. (2006) "Tropical Sustainable Architecture: Social and Environmental Dimensions", Elsevier, Amsterdam. ISBN-10: 0750667974
- Murray, S. (2006) "Disturbing Territories", SpringerWienNewYork, Vienna. ISBN-10: 3211252452
- Holl, s. (2000) "Paralax", Princeton Architectural Press, Princeton. ISBN 1-56898-261-5
- Gleining, A.; Vrachliotis, G. eds. (2008) "Complexity; Design Strategy and World View", Birkhauser; Basel, Boston, Berlin. ISBN-10: 3764386886
- Havel, I.M. (2003) "O strukturách" ("On Structures"), Vesmir (6), Praha; http://www.vesmir.cz/soubory/2003_V303.pdf
- Bauman, Z. (2002). "Tekuta Modernost" ("Liquid Modernity"), Mlada Fronta, Praha. ISBN: 8020409661
- Truax, B. (2001) "Acoustic Communication", Second Edition, Ablex Publishing, Westport. ISBN-10: 1567505376
- R. Murray Schafer, R. (1977) "The Tuning of the World", Alfred A. Knopf, Inc., New York
- Brebner, J. (1982) "Environmental Psychology in Building Design", Applied Science Publishers LTD, London. ISBN-10: 085334969X