

Ergonomics in the Practice of Project Architect on Selected Examples

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Abstract. Ergonomics is present in everyday design practice. Designers use it consciously or intuitively. They also do not take into account the realization of its principles. The paper presents a variety of examples of the application of ergonomic principles in the design. It shows the various aspects of ergonomic design selected examples of projects and the implementation of the author. It discusses ergonomics in kitchen technology, medical technology hospital facilities, hotels projects, industrial plants, water parks, playgrounds, etc. The purpose of this paper is to show the diversity of ergonomic issues occurring in daily practice. Demonstration of the need to start the design of the initial findings of ergonomic parameters, modules and optimization of technological systems. Ergonomics as a vital and necessary part of the initial phase of design - programming, which not only simplifies the design but also ensures optimum and safe use. Ergonomic design gives a measurable and tangible benefits for developers, investors and users. The paper is the author's statement, presents his point of view, ergonomic in design.

Keywords: architectural design, ergonomics in the design, building quality evaluation.

1 Theory

Ergonomics is one of the most important elements of architectural design. Ergonomics is part of the preliminary stage of design - programming. A large part of the principles of ergonomics ensure building regulations applicable in a given country. For example, the dimensions of the stairs, toilet cubicles, door width, the minimum amount of space, the minimum size for the data types of premises, the mandatory functional systems. In addition, the principles of ergonomics include provisions for such categorization of hotels, pharmaceutical design of pharmacies, health rules concerning back-kitchen, cloakroom workplaces, etc.

Ergonomics can be learned from the guides and the observations of the built environment - with observations designed space, methods of use and user behavior.

These functions where ergonomics is almost mandatory. These include for example: hotel rooms and hospital, kitchen facilities, operating theaters, pharmacies, etc. In these cases the application of ergonomics in the field of optimal functional

relations cannot be discretionary. But there are many features which the system depends on the creativity of the designer, his talent, skills, knowledge, experience, needs, investor, customer expectations, etc. The application of ergonomics is voluntary, so the built environment operate in both spaces ergonomically designed and unergonomic.

In the theory of qualitative research are noteworthy references: Preiser W., Rabinowitz H., White E. [1988]: Post-Occupancy Evaluation; Preiser W. [1989]: Building Evaluation; Preiser W., Vischer J.C. (red.) [2005]: Assessing building performance, Nasar J.L., Preiser W., Fisher T. [2007]: Designing for Designers: Lessons Learned from Schools of Architecture; Lang J. [1997]: Creating architectural architectural Theory. The role of the Behavioral Science in Environmental Design; Groat L., Wang D. [2002]: Architectural Research Methods; Zeisel J. [1990]: Inquiry by design, Tools for environment-behavior research; Johnson P.A. [1994]: The Theory of Architecture. Concepts, Themes & Practice; Anderzhon J., Fraley I.L., M. Green M. [2007]: Design for Aging Post-Occupancy Evaluations. Lessons learned from Senior Living Environments featured in the AIA's Design for Aging Review; Kernohan D., Gray J., Daish J., Joiner D. [1992]: User participation in building design and management. Architecture; Baird G., Gray J., Isaacs N., Kernohan D., McIndoe G. [1996]: Building Evaluation techniques; Duerk D.P. [1993]: Architectural programming. Information management for design; Foqué R. [2010]: Knowledge in architecture; van der Voordt T.J.M., van Wegen H.B.R. [2005]: Architecture in use. An introduction to the programming, design and evaluation of building; de Jong T.M. i van der Voordt D.J.M. [2005]: Ways to study and research. Urban, Architectural and Technical Design [1].

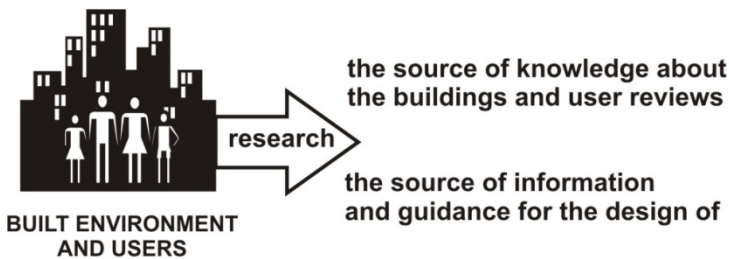


Fig. 1. Flow chart describing additional sources of knowledge and information derived from studies of the built environment and its users (the author's elaboration)

2 Own Research - Observations and Professional Practice

According to the author one of the effective methods of knowledge of good and bad practices of ergonomic solutions are qualitative study of existing objects. The entire built environment is a database of information. It is a database and a record of success and design errors. Reaching for the information you can get to know a good solution - worthy of attention and avoid mistakes.

There are many methods for assessing and obtaining information from the built environment as: POE (Post Occupancy Evaluation), REN (Real Estate Norm), BQM (Building Quality Assessment), FSA (Functional Suitability Assessment), STM (Serviceability Tools and Methods), PBAP&MM (Physical Building Audit Procedures and Maintenance Management), LCA&LCCA (Life Cycle Analysis & Life Cycle Costs Analysis), BIU (Building-in-Use), BPE (Building Performance Evaluation), BREEAM (Building Research Establishment Environmental Assessment Method), EPIQR, TOBUS, INVESTIMMO, LIFECON, EUROLIFEFORM, SUREURO, ECB&CS (Energy Conservation in Buildings and Community System Programme), EIA (Environmental Impact Assessment), GBC (Green Building Tool), LSA (Land Suitability Analysis), LEED (Leadership in Energy and Environmental Design), LCA (Life Cycle Assessment), LCC (Life Cycle Cost), LCCA (Life Cycle Costs Analysis), MSDG (Minnesota Sustainable Design Guide), SBE (Scenic Beauty Estimation), SIA (Scenic Beauty Estimation), MSBG (The State of Minnesota Sustainable Building Guidelines), VIA (Visual Impact Assessment) [1].

It is necessary to fit research methods and techniques to meet the needs of design, evaluation criteria, the specifics of the country. According to the author gives good results at the same time the use of several techniques such as observational studies, interviews-interviews and questionnaires. In his own practice as the most effective author acknowledges interview with the users in the form of a loose spontaneous conversation and interview with the manager object.

The author has developed its own simplified test methods: pre-design objects with similar functions, and after a period of use in order to verify design decisions.

It should be emphasized that qualitative research design are not widely used in all environments, architectural and countries. Leading are the United States, United Kingdom, Netherlands, Australia, also Sweden, Germany. In Poland, are rare. Built environment is divided into two groups: designers using traditional and modern methods of programming in this study. The traditional approach to design is based on the artistic vision of the architect. In contrast, the second research approach is based on the scientific method of qualitative research.

The author has developed its own simplified, rapid and effective method of research:

- Pre-project "in the 8-steps" of objects with similar functions. These studies are helpful in gaining knowledge of programming and design.
- Assessment object realized "in the 7-steps" when using the designed object. They provide a verification of the design decisions taken and the source of knowledge to new projects [1].

The methods are described in the book Fross K. [2012]: Quality evaluation in architectural design on selected examples, Publisher Silesian University of Technology, Gliwice, Poland. Additional information and diagrams copyright research methods can be obtained by writing to the author at: kladiusz.fross@wp.pl.

We own professional practice, the author applied the principles of ergonomics in projects: the hotel (module and layout of the hotel room), a water park (changing rooms, water attractions system), hospital (hospital functional layout, arrangement of

rooms, single, double bed ward, operating theater, the individual functional units), restaurant (kitchen back system), pharmacy (functional layout), factory (land development, production technology, social facilities staff), external recreation park (playground equipment safety zone), single-family house (layout of the rooms), an adaptation of an ancient palace in the new commercial functions (system function), the office of the city (optimal functional relationships departments).

An interesting example is the object hospital. When the design was used to optimize the ergonomics of functional relations, optimizing the dimensions and area of the house, character strings communications, supplies, maintenance and evacuation. First important was the optimal arrangement of a whole hospital in the major areas: admissions, individual wards and the operating theater and childbirth. Then the optimal (ergonomic) layout of the rooms of a single branch. At the same time he was an important model system in bed room (2-seater with a private bathroom). Optimally ergonomic and economical layout of the room with equipment imposed dimensions of the building and wheel design. The structural arrangement strictly the result of the adopted module (width) of the room. Next solved optimal systems of individual functional units as operating theater, pharmacy, hospital auxiliary functions, etc.



Fig. 2. Scheme line hospital in Siemianowice, Scheme of a typical floors (chamber receptions) and typical floors (branch bed). Project team: J. Kaminski NDN, Euro Project Dr. Fross, K. Fross, M. Jurkiewicz, visualization B. Braksator, 2013, an investor Nefrolux, Silbud Property Ltd., contractor Skanska construction work. (the author' s elaboration).



Fig. 3. Hospital in Siemianowice (Poland) under construction, 2013/2014. Photo: K. Fross 2013

3 Summary and Conclusions

- Noticeable is the universality of the application of ergonomics.
- Clearly ergonomics is one of the most important elements of architectural design.
- Ergonomics is part of the pre-design stage - programming.
- One of the most effective methods of knowledge of good and bad practices of ergonomic solutions are qualitative study of existing objects.
- The entire built environment is a database of information.
- It is a database and record the successes and mistakes of design also in terms of ergonomics.
- Reaching for the information you can get to know the good, ergonomic design - worthy of attention and avoid mistakes.
- Qualitative research has a direct impact on improving the quality of design and the objects themselves.
- There are many effective techniques to acquire information from the environment (methods developed by the author may be obtained by writing to the following address: klaudiusz.fross@wp.pl).

The summary diagrams are included for research quality and ergonomic solutions in projects.



Fig. 4. Examples of observational studies. “Tropical Island” - recreation park in Marklowice and “Rafa” – recreation park in Rydułtowy (Poland). Photo: K. Fross, 2008.



Fig. 5. Scheme recreation park “Tropical Island” in Marklowice (Poland), K. Fross project

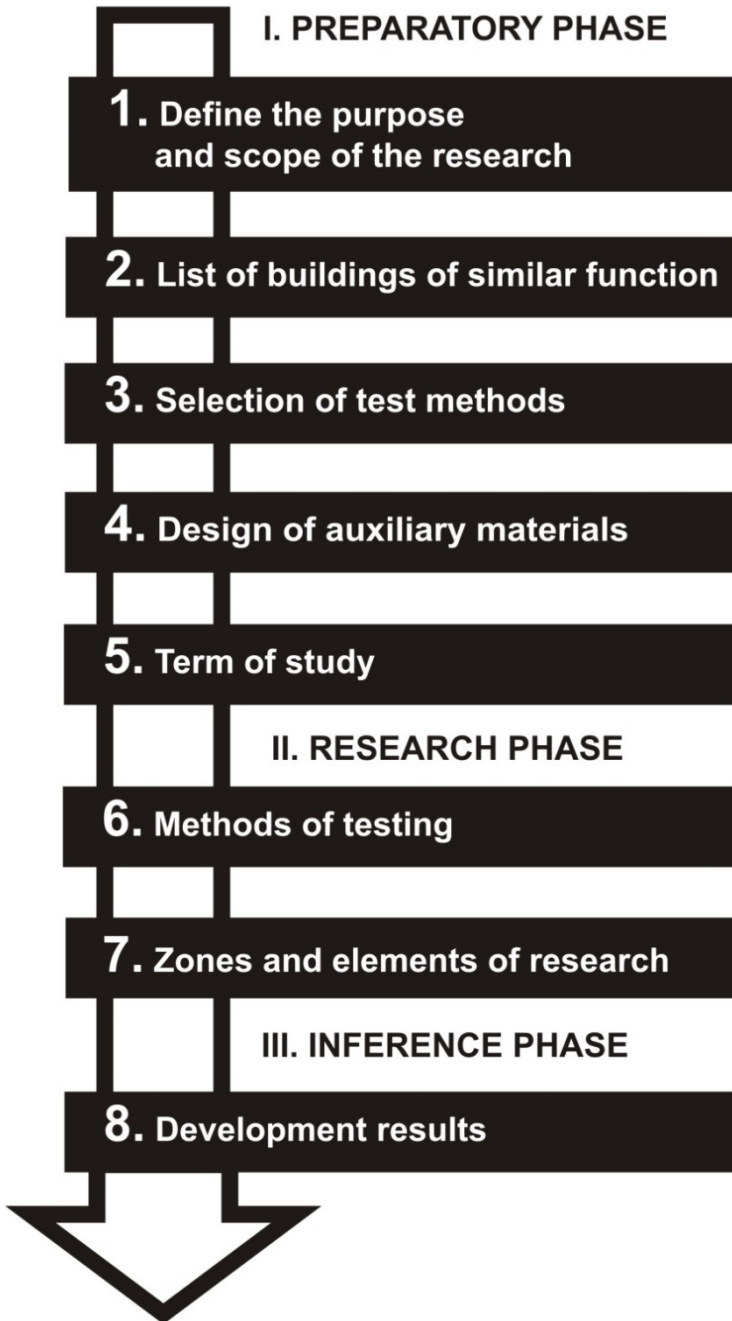


Fig. 6. Diagram of the author's method of pre-design studies in "the 8 steps" supporting the acquisition of knowledge required for programming and designing (the author's elaboration)

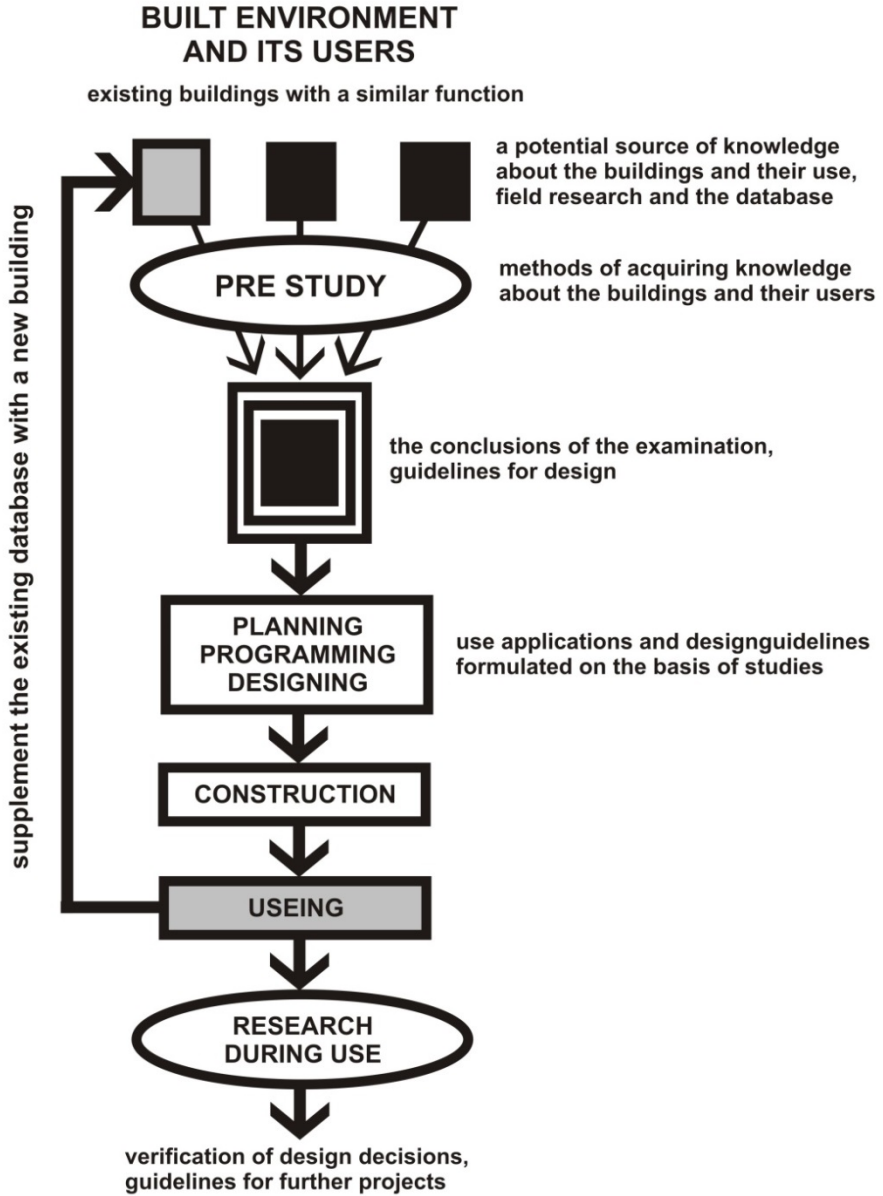


Fig. 7. General diagram recapitulating the research approach to the design process propagated by the author, supported by pre-design studies and verification in the course of using or occupying the constructed facility (the author's elaboration)

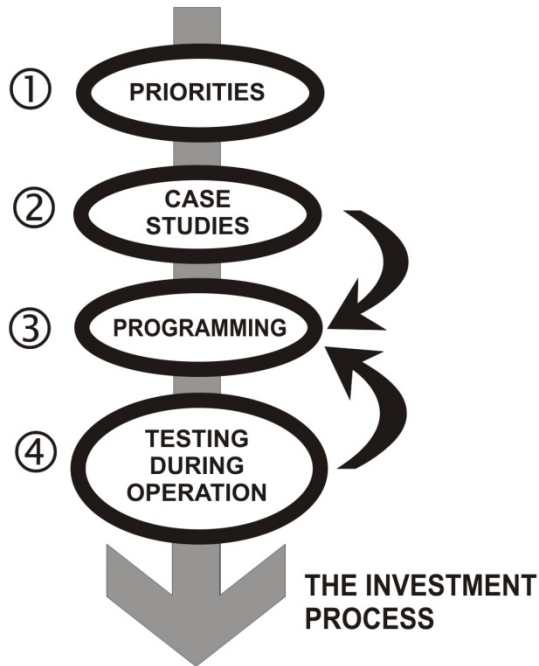


Fig. 8. Essential sources of knowledge in the investment process (the author's elaboration, 2010)

Reference

1. Fross, K.: Quality evaluation in architectural design on selected examples. Silesian University of Technology, Gliwice (2012)