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**AN ABSTRACT OF THE DOCTORAL THESIS ENTITLED:
THE POSSIBILITIES OF APPLYING REFLECTIONS
AND MIRROR ANAMORPHOSES: SPHERICAL, CYLINDRICAL
AND CONE IN ARCHITECTURE**

Keywords: *reflection, geometry, architecture, anamorphosis, visual arts*



Fig. 1. Adrien Fainsilber (arch.), Gérard Chamayou (constr.), *La Géode*, Cité des sciences et de l'industrie, parc de la Villette, Paryż, 1985 r. photo by Marek Pabich

An abstract of the doctoral thesis completed in the Faculty of Civil Engineering, Architecture and Environmental Engineering in the Lodz University of Technology. Supervisors: D Sc Weronika Wiśniewska Assoc. Prof., D Sc Wiesław Pawłowski Assoc. Prof.

The subject of research in this dissertation is the mirror reflection phenomenon analysed from the point of view of its application in architecture.

The basic aim of the study is to prove the thesis, that the knowledge of the mirror reflection phenomenon helps creating architectural space; it can contribute to enriching this space with elements positively stimulating its active reception; it can make it more serviceable, and even result in decreasing the amount of energy required to operate the buildings. The significant part of this knowledge is mirror reflections geometry, including catoptric anamorphosis geometry. Whereas

the mirror anamorphosis itself, introduced into space particularly valuable for a given community, could play a role of an object substantializing ideas vital for this community, its history and aspirations.

In order to prove these theses, the presence of the mirror reflection phenomenon in different research areas has been analyzed. In Chapter one, apart from introductory and methodological remarks, the physical aspect of mirror reflection phenomenon has been approached. In Chapter two, the natural phenomena and forms, in which the optical phenomenon of mirror reflection occurs, have been reviewed, in view of their usability in architectural planning. Chapter three gathers the most important facts from the history of material culture, concerning the development of mirror, and its use as an element of architecture. In Chapter four, the classification of visual effects, potentially achieved with the aid of mirrors, has been attempted. Eight types of visual effects have been defined, and their characteristic examples have been presented. The types of visual effects are: illusionistic multiplication of space, manifold increase of the object's picture, transfer of the desired view to the location where it would be impossible to achieve in direct way, dematerialization of architectural objects and elements, the surrounding space metamorphosis, the surrounding space deconstruction, catoptric anamorphosis, motion. In Chapter five, documentary evidence has been supplied for the examples of the use of mirrors, in which the solutions are adopted in line with the principle of balanced development. Mirrors, appropriately configured into optical systems, could, by the means of the transmission of light, or blocking its access, contribute to optimal additional illumination of the space inside a building, thus they could become important elements of the passive solar systems, and improve the building's energy balance. The other group of the uses of mirrors presented, is connected with the active concentration of solar energy, which could be used in the form of heat, for example to heat a building, or transformed into electricity and used in any other given way. In Chapter six, by means of methodological output of descriptive geometry, the solution to the problem of seeking the point of reflection from spherical, cylindrical, or conical plane, has been presented. In Chapter seven, the geometrical analysis has been made for three selected anamorphic transformations. Chapter eight presents the software *Anamorphosis*, which is an implementation of the theory of mirror anamorphosis geometry. The confirmation of the usability of this software were also two anamorphoses produced with its aid, which could become elements of Lodz urban public space.

The effects of the study and its findings confirm, that the formulated thesis was correct. The dissertation received, in orderly way presents the knowledge concerning mirror reflection phenomenon in architecture, and the examples of the uses of mirrors included, could inspire architects, and make solving design problems easier. While the considerations of mirror reflections geometry could become an element of further development of a design utility software (CAD).