ARCHITECTURAL MODELLING: TRANSFORMATIONS IN PERSPECTIVE SPACE.

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ABSTRACT

For the creation of architectural form, architects conventionally describe the idea of the building graphically in the cartesian co-ordinate system - usually called object space - first, by declaring the building vocabulary of elements, second, by employing some kind of grammar of shape through union, intersection, void and complements of elements, and third, by manipulating some rules of composition through translation, reflection, rotation and scale transformations of elements. Once the building typologies are created, then higher order of compositions of forms - morphologies - are generated through repetition of typologies along defined axes and paths.

Seldom in reality architectural forms, however, are identically perceived in spatial context compared to their graphical description in the cartesian space. Although architects use 2-D planar perspectives - freehand sketches and detailed point-projections - their feedback to cartesian space has been almost impossible. Even the 3-D conventional chip-board architectural models based on the cartesian space definition fail to represent the reality in context because of unnatural human viewfield angle, building scale discrepancy and lack of constancy of reference framework.

The recent research activity and developmental work in the area of computer graphics applications to architectural modelling indicate an emerging trend in geometric modelling of architectural forms which promises to hold direct feedback connection between the cartesian space and the perspective projection. This is achieved through the perspective space. With the computer integration in the creation of architectural form, architects can now describe the idea of the building graphically in the perspective space, check the building spatial relationship from different viewpoints, have full control over building elements in 3-D, manipulate them through symmetria, super-imposition and pattern generation transformations and, if satisfied with the results, feedback the design graphic information to the cartesian space for plans, elevations and sections projection or to the perspective projection for rendering purposes.

This paper attempts to illustrate graphically and mathematically all the architectural geometric transformations in the perspective space and their connections to the cartesian space. It applies the derivative and integrative transformations - the link between perspective and cartesian spaces - to advance not only understanding in generic inter-connections of primary forms, but also to expanding in design to a greater degree of freedom within the typologies and to generating new forms. It promotes the idea of perspective axonometric projection as a means for architectural chipboard graphic modelling for conceptualizing the building in interactive mode where constancy of reference framework could be assured and approaches to the building through different paths - parallel, diagonal and normal, as well as facadal and profile - could be tested.

KEYWORDS: Architectural modelling, perspective space, mathematical and geometric transformations, perspective axonometric projection.