Chapter 6

Conclusions and Future Work

6.1 Conclusions

Let's reiterate the main points of the thesis below.

- We have provided a review of perception of geometry in pictures and of the usage of perspective systems in the art (Chapter 2).
- We have suggested a classification of perceptually important geometric properties of images (structural and nonstructural) which is convenient for the study of general projections of the space into the plane from a perceptual point of view (Section 2.1).
- We have shown that a number of simple structural requirements (such as the absence of loops in the images of straight lines, the absence of twists in the images of planes,) when applied to all possible objects that can occur in a picture, lead to the conclusion that the fibers of the projection should be subsets of the fibers of a perspective projection. (Section 3.2).
- We have introduced two types of error functions which can be used as quantitative measures of distortions of curvature and shape. (Section 3.3).

- We have shown that the error functions cannot be simultaneously identically zero for any projection except orthogonal parallel. For each error function, however, there are projections for which the error function vanishes identically. (Section 4.3.2).
- We have described error functionals and formulated optimization problems that can be used to construct projections with minimized distortions. (Section 3.3.4.)
- We have found estimates of the optimal values of error functionals for the axially symmetric case and demonstrated that under certain assumptions simple interpolations have values of error functionals close to the optimal. (Section 4.3.3).
- We have described situations when distortions are likely occur and suggested methods to decrease them. (Chapter 5).

6.2 Future Work

There are a number of directions in which this work can be completed and extended.

The most immediate goals are

– to find better estimates of the optimal values of functionals and approximations to the solution of the optimization problem in Section 4.3;

– to consider other cases of simple symmetries; for example, projections similar to cylindrical.

A promising direction of work which we hope to pursue is suggested by the fact that conformal transformations preserve the direct view error function. That means that we can try to decrease curvature or achieve improvement in some other perceptual factor without causing additional distortion of shape, if we use conformal transformations of the picture plane.

The decomposition theorem from Chapter 3 applies to the case of connected regions of space. It is interesting to consider the ways of splitting the space into several disconnected parts and using a different projection for each of these parts.

We tried to avoid dependence on the contents of the scene. It is also possible to consider transformations that depend strongly on our knowledge of the geometry of the objects in the scene. In this case error functions have to be evaluated only for the actual images of objects rather than for all possible images and better results can be achieved at the expense of much greater complexity and lesser generality of the algorithms.