Let us pick a number x between 0 and 1, then multiply it by 2 (e.g. on calculator), write down integer part of obtained number (digit 0 or 1) and perform previous procedure on rational part of 2x again. If we repeat this procedure multiple number of times, writing down obtained integer parts after each operation, then we will obtain a sequence which is a binary approximation of x. Longer the procedure is performed, the better obtained approximation. It is the spirit of symbolic dynamics, which tries to analyze global behavior from local information contained in symbolic presentation. The map 2x can serve as a toy model of mixing, which is similar to kneading operation that bakers apply to dough. In this process dough is compressed, then cut into two halfs an stack one over another. In real life similar operation will ensure that ingredients of dough are well mixed provided that this operation is performed sufficiently long. In similar way wa may construct other simple one-dimensional models, e.g. describing evolution of population in biology, simple models in physics etc. It is interesting that many multi-dimensional models can be reduced to investigation of one-dimensional models. What more important, approach of symbolic dynamics is not limited by dimension of the model - we simply write down symbols representing regions that trajectory visits as a result of evolution in the model.

The aim of the project is analysis of symbolic systems, in main part related to one-dimensional dynamics. Through our research we want to gain a better understanding of mathematical description of mixing (its various gradations) and reveal how the structure of map under investigation is related to symbolic description it generates. Analysis of these recurrent structures should lead us to conclusions on general properties of the system under investigation. In other words we want to use knowledge about local properties of the system to anticipate asymptotic features of its evolution in long time perspective. Another property considered in the project, in some sense complementary to mixing, is rigidity. Let us imagine physical object which after some evolution comes back almost exactly to its initial state (e.g. roulette wheel with ball on it). The questions we consider ask how much complex can be evolution of this object (dynamical system) between its returns to almost the same position. In particular, we want to know if some kind of mixing is allowed in such models. Our models will be built on spaces similar to these in symbolic dynamics, not limited by boundaries set by the dimension of the space.