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This project is concerned with investigations of geometric properties of groups. Groups are mathematical objects that arose from the study of symmetries appearing in physics and group theory is one of central topics of modern mathematics, having applications in physics,
chemistry and computer science.

The current project touches various domains of pure and applied mathematics and there are tight connections with theoretical computer science. In pure mathematics, besides geometric and measured group theory, the project involves, among others, topology, differential and algebraic geometry, combinatorics (e.g. random graphs) and logic. Algorithmic graph theory and metric graph theory are the branches of applied mathematics on which we rely. Some methods and objectives take their origin in computer science (concurrency theory) and combinatorial optimization.

The project will be focused on answering several open problems on symmetry groups of combinatorial spaces with nonpositive curvature. These include both complexes glued of cubes, of regular simplices, and of ortoschemes, which are generalizations of isosceles right-angled triangles. Our groups come from a large variety of contexts such as the theory of braids, 3-dimensional topology, and algebraic geometry. We also plan to study how global properties of ergodic actions of groups determine their algebraic structure. This has important connections to mathematical logic via the complexity theory in descriptive set theory and the study of Borel equivalence relations.