Combinatorial non-positive curvature in group theory
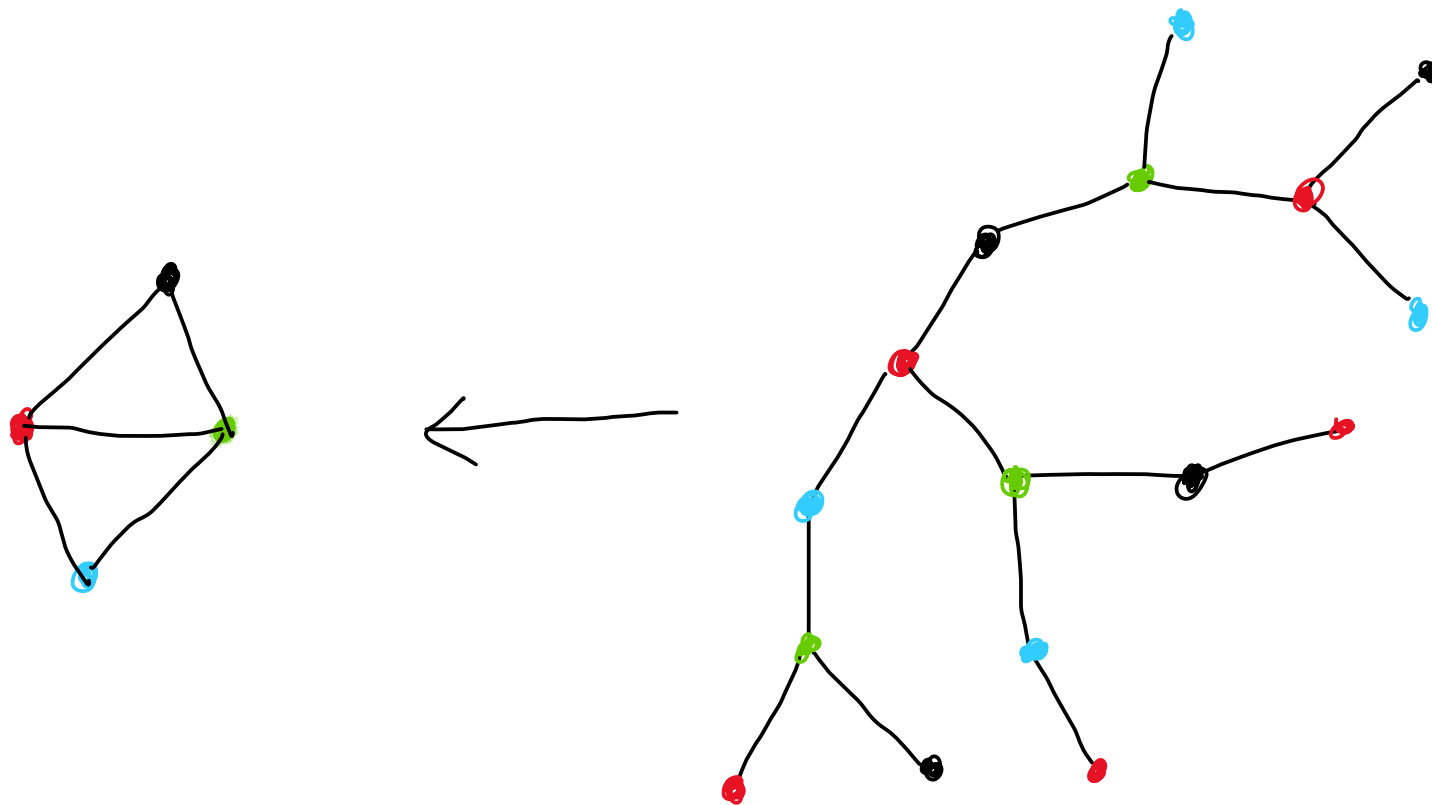
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In *Geometric Group Theory* we study groups by means of their actions on spaces.

From geometric/topological/large scale properties of the spaces we deduce algebraic/algorithmic features of the groups.
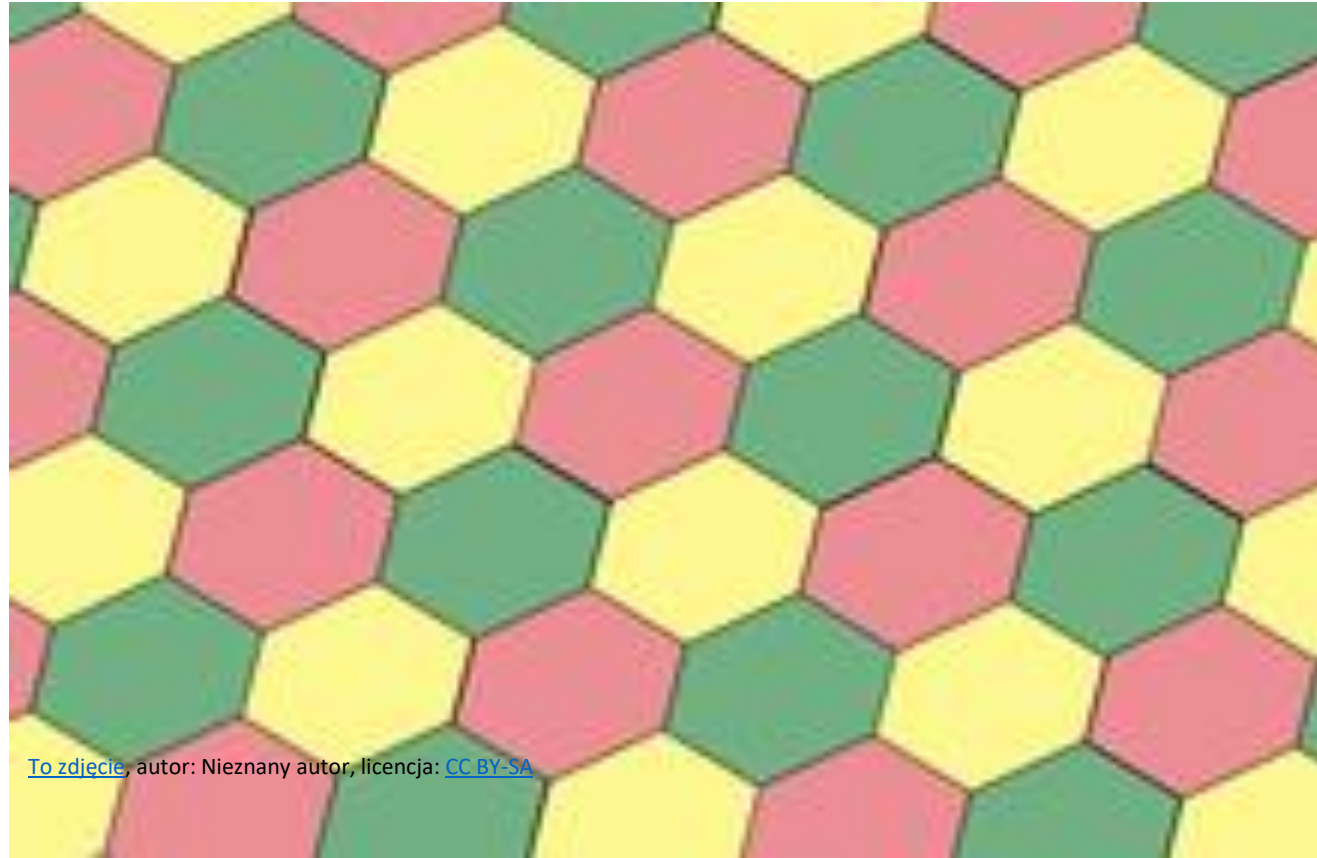
General Problem:

Find and study local combinatorial conditions (CNPC) on a polyhedral complex implying asphericity.
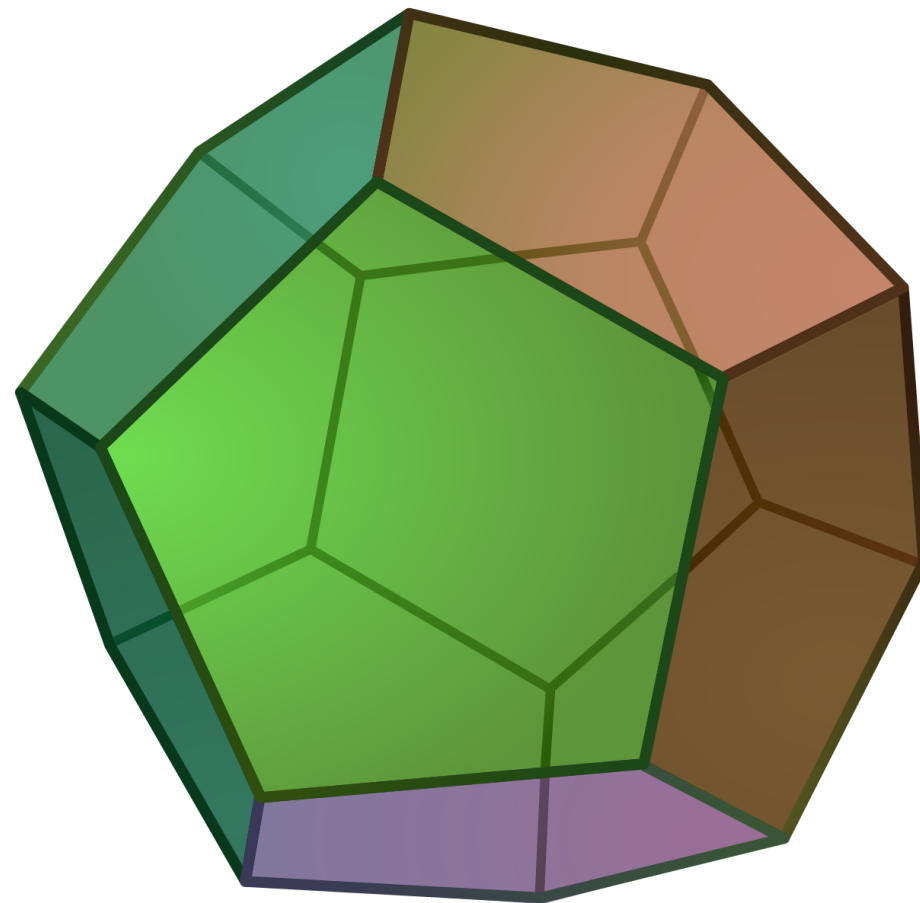
Example: 1-dimensionality

Example: 2-dimensional complex with 2-cells being n-gons with n>5 (small cancellation)

Non-example:

Higher dimensions:

- CAT(0) cubical complex
- systolic complex
- weakly modular complex
- Helly complex

Application #1:

Study „classical" groups:
- arithmetic lattices
- groups of birational transformations
- Coxeter/Artin/braid groups
- fundamental groups of complexified complements of hyperplane arrangements

Application #2:

Construct new (exotic) groups:
- high-dimensional Gromov hyperbolic groups
- groups not coarsely embeddable into the Hilbert space