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d-Representability of simplicial complexes of fixed dimension

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Let K be a simplicial complex with vertex set $V = \{v_1, \dots, v_n\}$. The complex K is d -representable if there is a collection $\{C_1, \dots, C_n\}$ of convex sets in \mathbb{R}^d such that a subcollection $\{C_{i_1}, \dots, C_{i_j}\}$ has a nonempty intersection if and only if $\{v_{i_1}, \dots, v_{i_j}\}$ is a face of K .

In 1967 Wegner proved that every simplicial complex of dimension d is $(2d+1)$ -representable. He also suggested that his bound is the best possible, i.e., that there are d -dimensional simplicial complexes which are not $2d$ -representable. However, he was not able to prove his suggestion.

We prove that his suggestion was indeed right. Thus we add another piece to the puzzle of intersection patterns of convex sets in Euclidean space.

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