

# On Limitations of the Ehrenfeucht-Fraïssé method in Descriptive Complexity

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## Abstract

We initiate a systematic study of the scope of the Ehrenfeucht-Fraïssé method. This method has been quite successful in descriptive complexity. However, for key problems such as  $P \neq NP$  or  $NP \neq \text{co-NP}$  no progress has been achieved using it. We show that for these problems it is already hard to get the board for the corresponding Ehrenfeucht-Fraïssé game. We obtain similar results for the so-called Ajtai-Fagin games and for variants where the structures are obtained randomly.