

# Preface

On the first few days of my PhD studies in the summer of 2009, my adviser Thomas Schwentick introduced me to dynamic complexity. Very recently Wouter Gelade, Marcel Marquardt, and Thomas had obtained a very nice characterization of regular languages in terms of dynamic complexity, and also a lower bound for the dynamic complexity of the alternating reachability problem. Many interesting problems in this area seemed to be awaiting a solution; and so I attempted to prove a lower bound for reachability. I was not successful. After two (at the end frustrating) months, I abandoned this project.

In the following two-and-a-half years I almost forgot about dynamic complexity. Decidability issues for the two-variable fragment of first-order logic turned out to be a much more accessible and fruitful field. Thomas and I obtained promising results, and a PhD in this field did not seem to be too far away. This was the moment when Thomas asked whether I would be interested in applying for funds from the DFG. If successful, such funding could relieve me from my teaching obligations.

We decided to have a second, deeper look into dynamic complexity, and to apply for funds for an extensive study of the power of logics in dynamic settings. At that time, the decision to spend more time on dynamic complexity was not easy for me. I was in the third year of my PhD and already had results and further ideas for two-variable logics; and it was not clear whether an application for funding would be successful. On the other hand, I now had more experience, which might be helpful for attacking the very same problems that I had tried to solve at the beginning of my PhD. I do not regret the decision.

With the thesis at hand I want to document the progress in dynamic complexity that we have made in the last two-and-a-half years. The focus of this thesis is on small dynamic descriptive complexity classes, in particular on lower bound methods for them. A short summary of results on decidability issues for two-variable logic is presented at the end of the thesis.

I am very grateful to Thomas Schwentick for all his support throughout the years of my PhD studies, and for being a great example of how to be a researcher and teacher. I thank the referees Erich Grädel and Thomas Schwentick as well as Cornelia Tadros and Jens Teubner for their work in my defense committee. Further, I thank Samir Datta, Sebastian Siebertz, and Nils Vortmeier for many fruitful discussions about dynamic complexity. I also thank the numerous colleagues at Dortmund and in the logic and database community for making

the last years a great time. Moreover, I thank Katja Losemann and Nils Vortmeier for proofreading parts of this work. I acknowledge the financial support by the German DFG under grant SCHW 678/6-1.

My warmest thanks goes to my family, to Katja, and to all my friends who supported me during the past couple of years.

January 2015

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Small Dynamic Complexity Classes

An Investigation into Dynamic Descriptive Complexity

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2017, VIII, 149 p. 17 illus., Softcover

ISBN: 978-3-662-54313-9