COST Action IC1205 on Computational Social Choice: STSM Report

Applicant: Dominik Peters
Home institution: University of Oxford
Home country: United Kingdom
Host: Prof Felix Brandt
Host institution: TU München
Host country: Germany
Dates: 17/08/2015 to 17/09/2015

My visit to Munich was both educational and productive; I immensely enjoyed myself and am grateful to my hosts and the COST action for giving me this opportunity, which was especially valuable considering the early stage of my research life. During my visit, I worked together closely with Prof Brandt and his PhD students, especially with Christian Geist. While initially intended to focus on hedonic games, our work ended up exploring a much wider variety of topics in Computational Social Choice.

One focus of our studies was a close examination of the proof of Moulin's theorem that every Condorcet extension exhibits a *No-Show paradox*: Moulin shows that there is a profile with 4 alternatives and 24 voters such that there is a 25th voter who will prefer not to submit his vote. We wondered whether this result could be tightened in the sense that there could be a smaller 4-alternative profile that is guaranteed to fail the participation axiom for all Condorcet extensions. Our method of attack was the use of SAT solving technology (as pioneered in the area of social choice by Christian Geist and others) (a) to produce voting rules that satisfy participation for profiles as large as possible and (b) to find proofs that there are no such rules starting at a certain number of voters. Using the additional restriction to *pairwise* (C2) functions, we were able to show that the No-Show paradox can be avoided for up to 11 voters, but must occur for 12 or more voters.

Concerning the topic of *hedonic games*, we were – to my great excitement – able to settle one of the main questions proposed in the application for this STSM: based on recent work by Martin Olsen, we showed that it is NP-hard to decide whether a simple symmetric fractional hedonic game admits a core-stable solution.

Other topics that we investigated were the size of maximum Condorcet domains, hardness of manipulation for a randomised voting rule, and the computational complexity of identifying 3-majority tournaments.

We expect some of these results to soon find their way into publications and have produced initial drafts.