COST Action IC1205 on Computational Social Choice: STSM Report

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I was visiting Piotr Faliszewski for one week, in Krakow, Poland. I had a great time in Krakow and with Piotr. During the first day, we discussed several problems, from which we selected the most interesting and promising one to work on, and in the following days, we worked on this problem.

The title for the paper to come from this initial work is probably something like: *Computational Complexity of Combinatorial Control by Adding Alternative*. Simply put, the problem is to control a given election, by means of adding bundles (that is) sets of new alternatives. The problem is that these sets of alternatives can be composed of alternatives which you want, but also alternatives which you do not want. More formally, we studied the following two general problems:

> $\mathcal{R}$ Combinatorial Control by Adding Alternatives
> **Input:** An election $E = (C, V)$, a set D of (unregistered) alternatives with $C \cap D = \emptyset$, a bundling function $\kappa : D \to 2^D$, a preferred alternative $p \in C$, and a bound $k \in \mathbb{N}$.
> **Question (Constructive):** Is there a subset of alternatives $D' \subseteq D$ of size at most k such that $p \in \mathcal{R}(\mathcal{C} \cup \kappa(\mathcal{D}'), \mathcal{V})$, where $\mathcal{R}(\mathcal{E}, \mathcal{V})$ is the set of winners of the election (E, V) under the rule $\mathcal{R}$?
> **Question (Destructive):** Is there a subset of alternatives $D' \subseteq D$ of size at most k such that $p \notin \mathcal{R}(\mathcal{C} \cup \kappa(\mathcal{D}'), \mathcal{V})$, where $\mathcal{R}(\mathcal{E}, \mathcal{V})$ is the set of winners of the election (E, V) under the rule $\mathcal{R}$?

We studied these two general problems for several voting rules $\mathcal{R}$: Plurality, Veto, k-approval, Borda, Copeland, and Maximin. It turns out that for some of these voting rules, the problem becomes computationally intractable when we introduce these bundles, as soon as the maximum size of the bundles is as small as two, but for some of them, the election can be controlled, even if the maximum size of these bundles is unbounded. Furthermore, we got some interesting results when considering the number n of voters as a parameter.

During this week in Krakow, we raised many interesting questions, and solved a large number of them. I hope that we will be able to solve some of the remaining questions in the near future, and publish a nice paper out of this research.