# SHORT TERM SCIENTIFIC MISSION (STSM) – SCIENTIFIC REPORT

**The STSM applicant submits this report for approval to the STSM coordinator**

**Action number: CA16228**
**STSM title: Various Open Problems for Fractional Hedonic Games**
**STSM start and end date: 18/03/2018 to 31/03/2018**
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The aim of this STSM was to tackle various open problems for fractional hedonic games. In collaboration with Paul Harrenstein and Dominik Peters, both of whom are at Oxford University, I have recently been working on a paper about fractional hedonic games, which discusses some of these open problems and had been finished shortly before arrival. In light of this, the focus of the STSM shifted to problems that seemed more relevant and promising.

*Strategic abstention in randomized social choice:*

Voting situations can be analyzed from a game-theoretic perspective by considering strategic voters, who may misrepresent, i.e., manipulate, their preferences if this yields a more preferred outcome. A variant of resistance to strategic manipulation is resistance to strategic abstention, which prescribes that a voter should never have an incentive to abstain the election by not reporting his preferences, or, in other words, should have an incentive to participate in the election. Moulin (1988) has shown that this property is violated by all Condorcet consistent voting rules. When allowing voting rules to randomize over the possible alternatives, the results are more positive, e.g., randomizing over all winners of Borda's rule yields an outcome that is Pareto efficient and weakly preferred to the outcome every voter could get by unilaterally abstaining the election, when preferences over randomized outcomes are based on stochastic dominance. These two properties are called *SD-efficiency* and *SD-participation*. A strengthening of SD-participation, called *strict SD-participation*, is obtained by requiring strict preference instead of weak preference in the definition of SD-participation. It is however open if any randomized voting rule satisfies both SD-efficiency and strict SD-participation. During my visit, Dominik Peters and I have been extensively working on this problem. We considered weakenings of strict SD-participation, for which we obtained some positive results and which might be helpful for resolving the full problem. *Strict SD-twins welcome* prescribes that a voter should have a strict incentive to participate in the election if there is another voter with the same preferences, called a twin, already part of the electorate. We were able to show that there are SD-efficient randomized voting rules that satisfy strict SD-twins welcome and that simultaneously either anonymity or neutrality can be satisfied. We also considered *strict SD-halfway monotonicity*, which requires that no voter can obtain a strictly preferred outcome by reversing his preferences. It is known that there are SD-efficient randomized voting rules that satisfy strict SD-halfway monotonicity, so we were trying to construct rules that additionally satisfy SD-participation or strict SD-twins welcome. Finding such rules is part of follow-up work.

*Approval voting:*

Another major part of our work during the visit has been on voting rules that aggregate the approval ballots of the voters stating their set of approved alternatives into a collective approval ballot. An appealing voting rule in this context is *approval voting*, which approves those alternatives that are approved by the most voters. Even though there has been a considerable amount of work on approval voting, we were able to obtain appealing new characterizations of it, some of which improve on known ones. We have shown that approval voting is the only voting rule that is faithful (i.e., sensible in one-voter situations) and satisfies reinforcement (i.e., consistency across variable electorates) and disjoint equality (i.e., selects all approved alternatives in two-voter situations with disjoint approval sets), which strengthens a result by Fishburn (1978), who required anonymity and neutrality in addition. Further results include characterizations of approval voting as the unique anonymous, neutral, and reinforcing voting rule satisfying either resistance to strategic manipulation, cloning consistency, or consistency with respect to reversal of the preference profile (plus weak side axioms).

Besides starting or continuing collaboration on these projects, I also got an opportunity to present ongoing work on a characterization of maximin strategies in two-player zero-sum games in the framework of epistemic game theory, for which I got valuable comments. I am grateful to the cost action for enabling this visit.