SCHLOSS DAGSTUHL
Leibniz-Zentrum für Informatik

Saarbrücken, July 14th, 2017

Schloss Dagstuhl:

The computer science of voting

Scientists from all over the world convened at Schloss Dagstuhl, the Leibniz Center for Informatics. Their common aim was to apply the methods of informatics to the scientific study of voting – from voting mechanisms to Gerrymandering.

Their research area, computational social choice, brings state of the art computer science research to bear on the question of the impact of electoral systems on election results. Computer scientists, economists and political scientists from 14 countries and 4 continents assembled in south west Germany to discuss voting rules. Together, they spend a week exploring the theoretical and practical challenges of this field of research. The mechanisms for political elections and voting in various societies and associations faced their scrutiny. Even decision mechanisms of networked computers, e.g., what answer an Internet search engine should provide, are part of the research in computational social choice.

The susceptibility of elections to legal manipulations was also a topic: Voters can sometimes obtain a better outcome if they take polls into account. If a candidate has no chance of actually being elected, his or her supporters may decide to vote for a close candidate who does have some chance to get elected.

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Voters adapt to the type of electoral system that they face. This is why the electoral system has an impact on how candidates campaign and who finally wins. For instance, in the recent US presidential elections Donald Trump has lost the direct popular vote, but he had won in the electoral college. If the US used a different electoral system, different campaigning strategies would have been used and, possibly, a different winner could have been chosen.

In the theoretical parts of the seminar, Dr. Piotr Skowron (University of Oxford, UK) and Professor Marc Kilgour (Wilfrid Laurier University, Canada) addressed the question of the best rule in the given context to select a group, e.g., a committee. The properties that should be exhibited by the resulting group will indeed differ – depending on whether for instance a Parliament is elected, or a set of finalists in a contest is chosen. A Parliament should indeed be representative of the diversity of the society and the different parties should be proportionally represented. In the case of a set of finalists it is the excellence of the chosen finalists, not their diversity, that matters. Another difference is in the number of people to be selected: The number of MPs in a Parliament is often fixed in advance while the number of finalists may sometimes depend on their quality.

Among the real-world applications, Professor Bernard Grofman (University of California, Irvine) dealt with the question of drawing constituency boundaries in the United States of America. He paid special attention to the problem of partisan and racial gerrymandering. Computer science may help in proposing tests for unconstitutional redistrictings. He compared the US practices with those of other countries. Dr. Vincent Merlin (Caen University, France) reviewed the literature to design voting mechanism for a Council or a Committee in a Federal Union. A practical application concerns the choice of the voting rule in an EU Council of Ministers: which weight should be awarded to each representative, and which quota should be used for the decision? Several fairness criteria have to be considered. The answers depend on the assumptions made on the voting behavior of the citizens in each jurisdiction.

During the seminar the issues of diversity, proportionality, and ethical questions have been considered in a continuous transfer between theory and applications: theory and applications tested each other. Theory provided the tools to get some insight from the reality. At the same time, the results obtained applying the tools permit a better understanding and further improvement of the tools.

The Dagstuhl-Seminar was organized by:

- Dorothea Baumeister (Heinrich-Heine-Universität Düsseldorf, DE)

- Piotr Faliszewski (AGH University of Science & Technology – Krakow, PL)

- Annick Laruelle (University of the Basque Country – Bilbao, ES)

- Toby Walsh (TU Berlin, DE)

More information about the seminar 17261 – "Voting: Beyond Simple Majorities and Single-Winner Elections" can be found at http://www.dagstuhl.de/17261.

Background:

During the whole year, Schloss Dagstuhl invites scientists from all over the world to come to northern Saarland in the south west of Germany to debate the newest scientific findings in informatics. More than 3,500 computer scientists from universities, research institutions and industry take part in various scientific events at Dagstuhl each year. Since 2005, Schloss Dagstuhl is a member of the Leibniz Association, which connects 91 leading non-university research institutes and scientific infrastructure facilities all over Germany. Because of their national importance, the federal government and the state governments jointly fund the institutes of the Leibniz Association.

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