OPERATIONS RESEARCH (ONLINE FORUM COMMENTARY)
Vol. 55, No. 2, March–April 2007, online commentary
ISSN 0030-364X | EISSN 1526-5463 | 07

INFORMS

Comment on "Thirteen Reasons Why the Vickrey-Clarke-Groves Process is Not Practical" by Michael Rothkopf

John Leyard
California Institute of Technology, jledyard@hss.caltech.edu, http://www.hss.caltech.edu/personal/jledyard

---

It is good to see a significant expansion of the few issues that Ted Groves tried to raise in 1977 about what are now known as VCG mechanisms. My comments here are intended to reinforce Professor Rothkopf's point that "research that aims to maintain the dominant truth-revealing strategies while compromising on the other practical issues is of limited practical value" and to challenge the computer science community to redirect its focus to tackle a deeper problem.

It is, or should be, well-known that VCG mechanisms are at most second-best mechanisms. Ted Groves and I emphasized this, in the context of mechanisms for public good allocations, by pointing out that even though majority rule often produces inefficient allocations, everyone could still better off than if a VCG mechanism were used because the private good was not wasted under majority rule. When VCG is used for auctions, this feature can produce significantly low revenues - reason 13, revenue deficiency, in the article. It is theoretically impossible to use a VCG mechanism and get a first-best allocation. We need to give up the search for the impossible, by relaxing the requirement of dominant strategies and turning to finding the best of the possible.

For example, it is well-known that there are an large number of Nash mechanisms that produce first-best allocations in equilibrium. The mechanisms in Groves-Ledyard (1977) are just one example of many with the property that if participants play Nash equilibrium strategies then the mechanism produces a first-best allocation. These mechanisms also generally seen to have significantly smaller communication and computation requirements than the VCG mechanisms, avoiding many of the 13 problems raised. And while one might question whether Nash equilibrium is the right strategic behavioral model, these mechanisms have been shown in economics experiments to work in practice. That is, humans using these processes do arrive at the allocations predicted by the theory.

So we know that VCG mechanisms are not first-best and that there appear to be better mechanisms which are not dominant strategy mechanisms. But we do not yet have a theoretical framework within in which to systematically find the best mechanisms. We do have a way to think about incentives and about participation options. We have found ways to impose constraints on optimization problems so that the solutions will be incentive-compatible and so that participation will be voluntary. What is missing, however, is a good, practical way to think about the issues raised by communication and computation. These are the same issues that cause most of the 13 problems for the VCG mechanism.

Some progress has been made by researchers in the area of Algorithmic Mechanism Design. But the number of equivalence classes of computational complexity (polynomial, NP-complete, etc.) is

too coarse to be of much help in practical mechanism design. For example, the "winners determination problem" for combinatorial auctions is computationally hard, nevertheless commercial auctions of hundreds of items (even over a thousand) have been successfully run with no computational problems at all. It would be helpful to have a finer measure of the "cost of complexity" to use in making choices among the many possible combinatorial auction mechanisms. It would also be helpful to be able to deal with computation and communication in the same way we have with incentives - by adding appropriate constraints to the mechanism design problem. Another drawback of recent research is that it is mostly focused on dominant strategy mechanisms.

I thank Michael Rothkopf for his helpful article reminding us why we should not become fixated on VCG mechanisms. I hope it refocuses researchers to develop a framework for more systematic mechanism design.

References

Groves, T. and J. Ledyard (1977) "Optimal Allocation of Public Goods: A Solution to the 'Free-Rider' Problem", Econometrica 45, No. 4:783-809.

Healy, P. (2006) "Learning Dynamics for Mechanism Design: An Experimental Comparison of Public Good Mechanisms", Journal of Economic Theory, 129, July: 114-149.

Kwasnica, A. M., J. O. Ledyard, D. Porter, and C. DeMartini (2005) "A New and Improved Design for Multi-Object Iterative Auctions," Management Science, 51(3), March: 419-434.

Lin, J., K. Takeuchi, Y. Chen, T. Finholt (2006) "Facilitation Large-scale Collaboration Through Effective Mechanism Design: An Economic Examination of Resource Allocation in Collaboratories," University of Michigan working paper