Deliberation, Single-Peaknedness, and Voting Cycles

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Many authors have argued that voting cycles, i.e., cyclic social preferences, and more generally Arrowian impossibility results can be avoided by public deliberation before aggregation [9, 7, 2]. The argument is based on two observations. First is the mathematical fact that pairwise majority voting always outputs a Concorcet winner when the input preference profile is single-peaked. Second are the conceptual arguments [9, 7, 2] and the empirical evidence [8] that deliberation fosters the creation of single-peaked preferences, which is often explained through the claim that group deliberation helps to create "meta-agreements" [7, 2].

Meta-agreements are, however, not necessarily less demanding than full agreements [11]. Preference cycles are in furthermore unlikely to occur, except in a specific class of cases called impartial cultures—c.f. [4, 12, 13] for empirical evidence and [10, 5] for theoretical results. In view of this, this paper addresses two questions:

Q1 Can voting cycles be avoided by pre-voting deliberation in cases where they are most likely to arise?

Q2 If yes, are meta-agreements or the creation of single-peaked preferences helpful for that?

In this paper, we argue that the received view, i.e., which answers "yes" to both questions, must be heavily qualified. On the one hand, we show that pre-voting deliberation does indeed help to avoid voting cycles. We also show, however, that in many, and arguably the most interesting cases it does *not* do so by creating single-peaked preferences. In other words, deliberation does appear to perform the desired task of rooting out voting cycles and avoiding associated impossibility results. However, in the general case, the emergence of single-peakedness is neither necessary nor particularly helpful for this purpose. We thus answer the first question with an emphatic "yes" but the second with a qualified "no."

We show this in a minimalistic, computational model of group deliberation. In this extended abstract, we only describe it informally. The participants enter deliberation by holding certain preferences, either weak or strict, over a given set of alternatives. Each participant then publicly announces, in turn, her full preference ranking. They do so sincerely and in a random order. After each announcement the participants update their ranking, using a distance minimization rule. That is, their new preference ranking is one that minimizes a given distance measure to their old ranking, and the one just announced, with possibly a bias towards their own preferences. The domain of preference

rankings in which they move during deliberation is either the set of all possible strict rankings or the set of all possible weak ones. We use and compare the effects of three well-known distance measures between orderings: the Kenemy-Snell [6], Cook-Seiford [1] and Duddy-Piggins [3] distance. Deliberation continues for a fixed number of rounds, after which we check whether the resulting preference profile, if not already consensual, is single peaked and whether it would generate a voting cycle.

Here is a short overview of the results. We first study the effect of deliberation, conducted using each of our three distance measures, on voting cycles. When working with weak rankings, deliberation eliminates *all* voting cycles, irrespective of the distance measure we use, except when the participants are heavily biased towards themselves. When restricting to only strict rankings, almost all cycles are eliminated as long as the participants weigh their own preference not more than twice the preferences of others. From there on all three measures enter a short transition phase after which they stop eliminating cycles. Turning to the claim that deliberation creates single-peaked preferences, we observe that at the outset very few of the starting profiles in our simulations have this property. Given the scarcity of groups starting with single-peaked preferences, our model supports the claim that such preferences are fostered by deliberation. For strict rankings, again as long as the participants weigh their own preferences not more than twice the preferences of others, deliberation creates 100% single-peakedness. With weak preferences, on the other hand, in the best case deliberation creates an increase of only about 10% of single-peaked preferences. For strict rankings, single-peakedness plays an important role in the elimination of cycles. Almost all starting cycles are eliminated by becoming single peaked. When we move to weak rankings, however, the creation of single-peaked profiles has at best a marginal effect on the elimination of voting cycles. The vast majority of profiles that become single-peaked through deliberation were *not* cyclic beforehand, and again the vast majority of profiles where deliberation eliminates voting cycles do *not* end up single-peaked.

These results provide with a favorable view of pre-voting deliberation, but a more subtle one than previously observed. Even under the unfavorable impartial cultures, deliberation indeed steers the group away from voting cycles, and thus makes coherent aggregation possible. Perhaps surprisingly, however, single-peaked preferences do not always play an essential role in that process. Since this model completely abstracts away from the notion of meta agreement, it provides furthermore an alternative, less demanding explanation as to how pre-voting deliberation can avoid cyclic social preferences, one that shifts the focus from the creation of single-peaked preferences to rational preference change and openness to change one's mind upon learning the opinion of others.

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