Decision Making in a Committee

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***Abstract*—This paper was produced with absolutely no prior research. The data is completely made up and bears very little relevance to the paper's title or the work conducted. Consequently any conclusions that might be made are wholly invalid. Nonetheless the findings of this paper indicate that the popularity of nihilistic thought grew steadily over the course of the 20th Century. That growth has been accelerated in the last 13 ± 2 yrs by the introduction of social media and 'memes'.**

***Index Terms*—Nihilism, Social Media, Social Behaviour.**

I. Introduction

A. Background

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II. Method

The results were obtained using the Wolfram Mathematica computing system, see Appendix A for the code used. The method used can be split up into 3 main components: constructing and manipulating graphs for our committee; calculating the dissensus using these graph methods; and collecting the data.

A. Graphing

1) Creating the graph: The first step was to create a cyclic graph with n nodes, each connected to their k nearest neighbors. The nodes were randomly assigned binary opinions of 1 or 0, see Fig 1(a), then the links between neighbors were randomly rewired with probability e, as can be seen in Fig 1(b). The resultant structure and connections of the graph remained constant throughout the rest of the process.

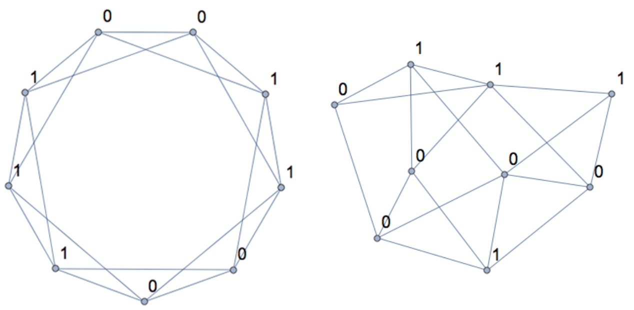

Fig. 1. (a) A graph with $n = 9$, $k = 4$ and (b) a graph with the same parameters but rewired with probability $e = 0.1$.

2) Paths: An update was carried out random-sequentially through the nodes, ie in each iteration a random path across the nodes was chosen and the states of each node were updated sequentially using a majority rule. Once all of the nodes had been updated (once each), a new random path was assigned and the nodes were once again updated, see Table I below for an example. Updates were carried out dynamically: within an iteration node states were called as their neighbor was reached in the path, not once at the beginning; ie if node 5's state was changed to 1 from 0, the new state (1) is used for subsequent calculations involving node 5 in the same iteration.

TABLE I
An example of random-sequential paths.

Iteration	Path across nodes
1	$3 \to 1 \to 5 \to 6 \to 2 \to 7 \to 4$
2	$5 \to 3 \to 7 \to 4 \to 2 \to 6 \to 1$
3	$7 \to 5 \to 4 \to 1 \to 6 \to 3 \to 2$

3) Majority Rule: The state of each node was updated using a majority rule with a threshold, $h \in [0.5, 1]$. A majority above the threshold, h, was required for the state of a node to be updated. See Table II below.

TABLE II
An example of the majority rule with $h = 0.6$.

Node value	Connected values	New value
0	0, 0, 0, 1, 1	0
0	0, 0, 1, 1, 1	1
1	0, 0, 0, 1, 1	0

B. Dissensus

Dissensus was calculated using the committee size and the final population with state 0, across all possible values of the initial population with state 0. This gives

$$D(N) \equiv \left\langle \Theta\left(1 - \frac{max(S_f, N - S_f)}{N}\right)\right\rangle_{S_i} \tag{1}$$

where N is the committee size, S_f the final population with state 0, S_i the initial population with state 0, $\langle\cdot\rangle_{S_i}$ the mean across all possible values of S_i, and $\Theta(x)$ the Heaviside step function (0 for $x = 0$ and 1 for $x > 0$).

C. Data Collection

Two forms of final data were collected: evolution plots displaying how the states of members changed through the iterations; and plots showing how dissensus varied with respect to k, h, e, and N.

1) Evolution Plots: With $k = 8; h = 0.6; e = 0.1$, the graphing algorithm was run for 4 iterations with committees of size $N = 10, 20, 30, 40$. Each of these was then repeated 4 times. A block plot was created for each run, where opinion 1 was represented by a black block, and 0 by a white block. Each row in the plots represents one iteration, starting from the top row with the initial configuration where no updates had been carried out, down to the bottom row where 4 updates had been carried out. The result was 5 plots for each committee size.

2) Dissensus Plots: The graphing methods were run with varying values of k, h, e, and N. For each of these dissensus was calculated 40 times for each $S_i = 0, 1, ...N$. From this the mean was calculated across all S_i, giving a value of $D(N)$ for a specific k, h, e, varying with N.

III. Results and Analysis

A. Evolution

Through our evolution plots, see Fig. 2, we can see that in general the smaller the committee, the more likely they are to reach a consensus.

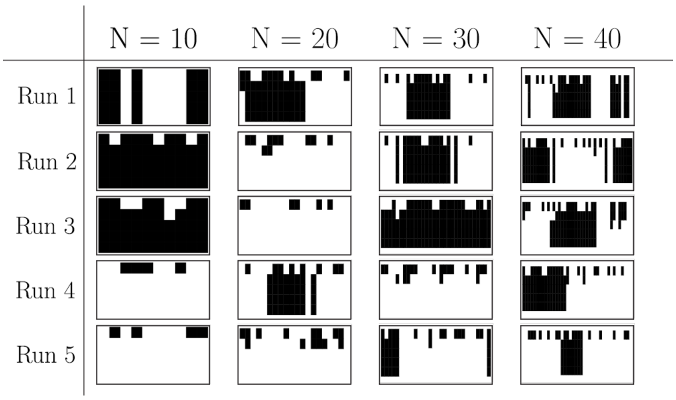

Fig. 2. Evolution of opinions of members through 4 iterations. 5 committee sizes were chosen ($N = 10, 20, 30, 40$) and each setup was run 5 times. $k = 8; h = 0.6; e = 0.1$

For $N = 10$ only one of the runs reached a state of dissensus, with all four of the others agreeing completely by the second update (three of five runs actually reached consensus after the first update).

For $N = 20$ there was a little more resistance in reaching a consensus. Three of five runs reached a consensus, but this time taking a little longer ($1 - 3$ updates).

For $N = 30$ only two runs reached a consensus, both taking 2 updates to get there.

For $N = 40$ none of the runs reached a consensus.

B. Dissensus

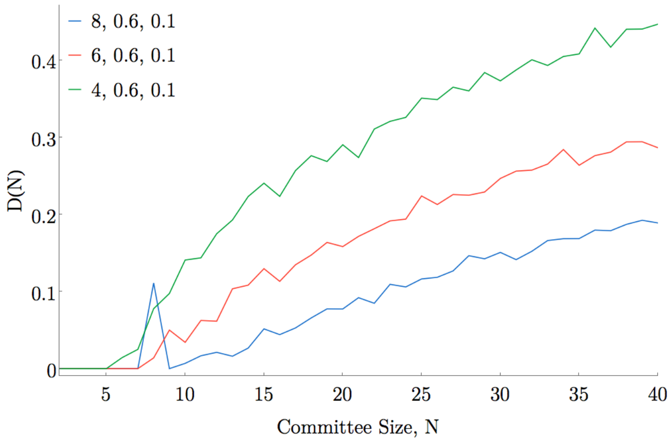

Fig. 3. (a) A graph with $n = 9$, $k = 4$ and (b) a graph with the same parameters but rewired with probability $e = 0.1$.

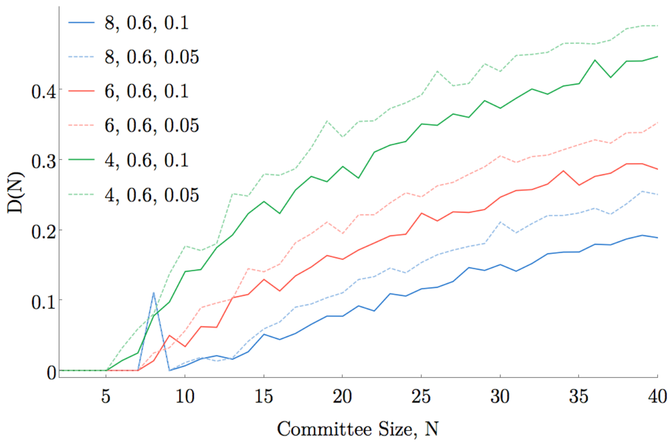

Fig. 4. (a) A graph with $n = 9$, $k = 4$ and (b) a graph with the same parameters but rewired with probability $e = 0.1$.

IV. Discussion

V. Conclusion

References

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Appendix