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**Information retention in heterogeneous majority dynamics.** (English) Zbl 1405.91515

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**Summary:** A dynamics retains a specific information about the starting state of a networked multi-player system if this information can be computed from the state of the system also after several rounds of the dynamics. Information retention has been studied for the function that returns the majority of the states in systems in which players have states in  $\{0, 1\}$  and the system evolves according to the majority dynamics: each player repeatedly updates its state to match the local majority among neighbors only. Positive and negative results have been given for probabilistic settings in which the initial states of the players are chosen at random and in worst-case settings in which the initial state is chosen non-deterministically.

In this paper, we study the (lack of) retention of information on the majority state (that is, which states appear in more players) for a generalization of the majority dynamics that we call heterogeneous majority dynamics. Here, each player  $x$  changes its state from the initial state  $\mathbf{b}(x) \in \{0, 1\}$  to the opposite state  $1 - \mathbf{b}(x)$  only if there is a surplus greater than  $a_x$  of neighbors that express that opinion. The non-negative player-dependent parameter  $a_x$  is called the stubbornness of  $x$ . We call stubborn the players which never change opinion when they are part of the majority. We give a complete characterization of the graphs that do not retain information about the starting majority; i.e., they admit a starting state for which the heterogeneous majority dynamics takes the system from a majority of 0's to a majority of 1's. We call this phenomenon “minority becomes majority” (or mbM) and our main result shows that it occurs in all graphs provided that at least one player is non-stubborn. In other words, either no player in the majority will ever change its state (because they are all stubborn) or there is a starting configuration in which information regarding the majority is not retained and minority becomes majority.

Our results are closely related to discrete preference games, a game-theoretic model of opinion formation in social networks: an interplay of internal belief (corresponding to the initial state of the player) and of social pressure (described by the heterogeneous majority dynamics). Our results show that, because of local strategic decisions, the global majority can be subverted.

For the entire collection see [\[Zbl 1381.68004\]](#).

**MSC:**

- [91D30](#) Social networks; opinion dynamics
- [05C90](#) Applications of graph theory
- [68M11](#) Internet topics
- [91A43](#) Games involving graphs
- [91-04](#) Software, source code, etc. for problems pertaining to game theory, economics, and finance

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