# Supporting Information S1 Appendix

In order to investigate the model robustness to changes in parameter values, we have performed a sensitivity analysis in which the hysteresis diagrams are plotted for various modifications of parameters.

 

**(b)**

**(a)**



**(d)**



**(c)**

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**S1 Fig. 1. Sensitivity analysis - migration rate.** The migration rate is a critical parameter since it controls the mechanism that breaks up local clusters of strong identities. The hysteresis phenomenon is investigated for reduction of the migration rate, from the setting of in the main text, shown in panel (a) for comparison, to lower levels: in panel (b), in panel (c), and in panel (d). For the strongest identity, the hysteresis effect breaks up at . (Experiment set-up as in main text, but only 10 runs per data point.) As is seen in this figure, the hysteresis phenomenon is starting to break up when is reduced from , the setting used for the investigation in the main text, to , at least for the strongest identity; cf. panels (a) and (c).



**(b)**

**(a)**

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**(c)**

**(d)**

**S1. Fig 2. Sensitivity analysis - other parameters.** The hysteresis phenomenon is investigated for changes in parameter settings. Panel (a) for the main text setting, c.f. regarding (b) exploratory strength changes , (c) the strength limits, and (d) the total number of connections, all in comparison with the main text result shown again in panel (a). (b): Reducing from 5 to does not change the result. (c): Changing the strength limits from [0.05, 0.95] to [0.01, 0.99] results in a stronger hysteresis effect, primarily since it will be more difficult for low strength identities to increase their strength. (d): Increasing the number of connections from 8 to 12 leads to a similar hysteresis pattern. (Experiment set-up as in main text, but only 10 runs per data point. For panels (c) and (d) each run involves 400,000 learning updates.) Changing the exploration constant , that sets the interval size for random explorations of strength changes does not seem to have a strong effect on the hysteresis phenomenon. In the main text investigation, we have limited the (transformed) strength values to . (For this test 400,000 learning updates have been used.)