John, Richard and the Evolution of Influence Networks

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Peng Jia

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John is adored by his students:



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John is adored by his students:



Richard implements perfect plans:



What are the consequences of these social structures?

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The dynamics of opinions	The dynamics of opinions
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DeGroot opinion dynamics model y(t+1) = W y(t) Opinions $y \in \mathbb{R}^n$ Influence network = row-stochastic W by P-F: $\lim_{t\to\infty} y(t) = (w^T y(0))\mathbb{1}_n$ where w is dominant left eigenvector of W Self-weights $W_{ii} =: x_i$ Interpersonal accorded weights W_{ii} Relative interpersonal accorded weights C_{ij} , where $W_{ij} = (1 - x_i)C_{ij}$ $W(x) = \operatorname{diag}(x)I_n + \operatorname{diag}(\mathbb{1}_n - x)C$	The dynamics of social power and self-confidence Reflected appraisal hypothesis by Cooley, 1902: individual' self-appraisal (e.g., self-confidence, self-esteem, self-worth) is influenced by the appraisal held by others of her Mathematization: along a sequence of issues, individual dampens/elevates self-weight x _i according to her relative prior control

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Star topology: emergency of autocracy

Lemma (Convergence to autocracy)

Iff graph has star topology with center j:

- there are no non-trivial fixed points of F
- for all initial non-trivial conditions, $\lim_{k\to\infty} x(k) = \lim_{s\to\infty} w(x(k)) = e_j.$
- Autocrat appears in center of star topology
- Extreme power accumulation!



issue A

Sociological investigation of CDS at 20

Conclusions

- John: self-confident and influential
- Richard: great manager and collaborator
- ... inexorable consequences of their surrounding interpersonal nets!

Coworkers: Peng Jia (Mech Eng, UCSB), Ana MirTabatabaei (Bosch), Noah Friedkin (Sociology, UCSB)

Reference: *Opinion Dynamics and The Evolution of Social Power in Influence Networks.* SIAM Review, 2013, under review

Funding: Institute for Collaborative Biotechnology through grant W911NF-09-D-0001 from the U.S. Army Research Office

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