Work in Progress

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The double edge of demographic faultlines
The neglected effects of crisscrossing on cohesion and performance in work teams.

The Problem
The Model
Results I:
Long vs. Short Term
Results II:
Positive Effects

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Rational Choice Sociology: Theory and Empirical Applications December 6th, 2007 in Venice

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The Problem

What effect does demographic diversity have on cohesion in work teams?

- ↳ Theorists expect a negative effect (see e.g. Williams and O'Reilly 1998)
- ↳ Empirical research produced unclear picture
- ↳ New idea by Lau and Murnighan (1998): effect is moderated by the strength of the demographic faultline

A faultline is the **stronger** the higher correlation between the demographic attributes is.

	Attribute	Member A	Member B	Member C	Member D
Group 1	Gender	male	male	female	female
	Age	20	40	20	40
	Skin color	black	white	white	black
Group 2	Gender	male	male	female	female
	Age	20	20	40	40
	Skin color	white	white	black	black

The Problem

Intuition 1: Lau and Murnighan's theory

- **New teams go through a "sensemaking process of understanding each other and their task" (1998: 332)**
- **two main mechanisms play a role**
  - Homophily: Actors prefer to interact with similar team members
  - Social Influence based on Persuasive Arguments:

    "group members who support similar attitudinal positions will find that, as other members support that position using arguments different from their own, they each have more reason to become even more extreme than they were before" (1998: 332)
- **In teams with strong faultlines the interplay of the two mechanisms can lead to group polarization.**
  - Opposing opinions: formation of demographic subgroups that disagree
  - Little communication: members of different subgroups refuse to interact
  - Likely consequence: Low cohesion and bad performance

Intuition 2: The Classical Sociological Argument

- **Focus on the integrating effects of cross cutting**
  - "Take the case of a tension between blacks and whites. If the lines of cleavage cross, each opposition will weaken the other. But if, as sometimes happens, all the employers are white and all the employed are black men, then one antagonism reinforces the other and the rift in society is deeper then ever. So, paradoxical as it may sound, a society riven by a dozen oppositions along lines running in various directions may actually be in less danger of early break-up than one split along just one line. For each new cleavage narrows the cross cleft, indeed, you might say that the society is sewed together by its inner conflicts"(Ross 1920: 164-165)
- **Different mechanism: Crisscrossing agents conciliate (e.g. Colson 1953)**
  - Crisscrossing agents share at least one demographic attribute with members of the two mutually exclusive demographic subgroups
  - They interact with all team members and thus allow for indirect communication between the subgroups and opinion convergence.

	f = 1			*f* = 0.8			*f* = 0.6			*f* = 0.4			*f* = 0.2			*f* = 0		
i	attr. D_1	attr. D_2	attr. D_3	attr. D_1	attr. D_2	attr. D_3	attr. D_1	attr. D_2	attr. D_3	attr. D_1	attr. D_2	attr. D_3	attr. D_1	attr. D_2	attr. D_3	attr. D_1	attr. D_2	attr. D_3
1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1
4	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1
5	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-1	-1	1
6	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-1	-1	1	-1	1	-1
7	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-1	1	-1	-1	1	-1
8	-1	-1	-1	-1	-1	-1	-1	-1	1	-1	1	-1	-1	1	-1	-1	1	-1
9	-1	-1	-1	-1	-1	1	-1	1	-1	-1	1	-1	-1	1	1	-1	1	1
10	-1	-1	-1	-1	1	-1	-1	1	1	-1	1	1	-1	1	1	-1	1	1
11	1	1	1	1	-1	-1	1	-1	-1	1	-1	-1	1	-1	-1	1	-1	-1
12	1	1	1	1	1	1	1	-1	1	1	-1	-1	1	-1	-1	1	-1	-1
13	1	1	1	1	1	1	1	1	-1	1	-1	1	1	-1	1	1	-1	-1
14	1	1	1	1	1	1	1	1	1	1	1	-1	1	-1	1	1	-1	1
15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-1	1	-1	1
16	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-1	1	1	-1
17	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-1
18	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
19	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Σ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

- The number of crisscrossing agents decreases as faultlines become stronger. However there are always some of them if faultline strength is not maximal.

The Problem

The Puzzle

- Both Faultline theory and the theory of crisscrossing agents predict that faultline strength hampers cohesion

However, faultline theory is challenged by the theory of crisscrossing agents.

- Which effect is stronger: the polarization breeding interplay of homophily and social influence or the integrating function of crisscrossing agents?

The Problem

The Model

Results I:
Long vs. Short Term

Results II:
Positive Effects

The Model

- **Agent based computational model of the opinion dynamics in work teams**
- **Each agent is described by**:
  - Demographic attributes (fixed): $a_{id}^{fix} \in \{-1;1\}$
  - Opinions on issues (open to influence): $-1 \le a_{ik}^{flex} \le +1$
  - An agent's opinion on a certain issue depends on the number of salient pro and con arguments. The more pro arguments an agent uses, the more positive his opinion will be.
- **What happens in each simulation round?**
  1. Random selection of an agent *i*
  2. Selection of an interaction partner *j* – based on **homophily**
  3. *i* adopts one of *j*'s arguments – based on **persuasive arguments**

The Model

- Selection of an interaction partner *j* :
  - Computer calculates the similarity between *i* and his team mates

$$sim_{i^*,j} = \frac{1}{2\cdot(D+K)}\left(\sum_{d=1}^{D} 2 - \left|a_{id}^{fix} - a_{jd}^{fix}\right| + \sum_{k=1}^{K} 2 - \left|a_{ik}^{flex} - a_{jk}^{flex}\right|\right)$$

  - The higher the similarity between *i* and *j*, the more likely they will interact

$$p_{j^*} = \frac{\left(sim_{i^*,j}\right)^h}{\sum_{i \neq j}^{N}\left(sim_{i^*j}\right)^h}$$

h: strength of homophily

- *i* adopts one of *j*'s arguments:
  - Computer randomly selects an issue to update
  - Computer randomly selects one of *j*'s arguments to be adopted by *i*
  - If the argument is new for *i* then one of his initial arguments will not be salient anymore.

The Model

- Example of the updating process

(a)

$$\text{Arguments} = \begin{pmatrix} +1 & +1 & +1 & +1 & +1 \\ +1 & +1 & +1 & +1 & +1 \\ +1 & +1 & +1 & +1 & +1 \\ -1 & -1 & -1 & -1 & -1 \\ -1 & -1 & -1 & -1 & -1 \\ -1 & -1 & -1 & -1 & -1 \end{pmatrix}$$

(b)

Initial saliency matrix of i

$$\text{Saliency}_{i^*} = \begin{pmatrix} 0 & 3 & 0 & 1 & 0 \\ 1 & 2 & 0 & 0 & 0 \\ 2 & 0 & \boxed{2} & 3 & \textcircled{0} \\ 0 & 0 & 3 & 0 & 3 \\ 3 & 0 & 1 & 2 & 2 \\ 0 & 1 & 0 & 0 & 1 \end{pmatrix}$$

(c)

Initial saliency matrix of j

$$\text{Saliency}_{j^*} = \begin{pmatrix} 0 & 1 & 0 & 3 & 2 \\ 1 & 3 & 0 & 0 & 0 \\ 0 & 0 & \boxed{3} & 0 & \textcircled{3} \\ 3 & 2 & 2 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 \\ 2 & 0 & 0 & 2 & 1 \end{pmatrix}$$

(d)

Updated saliency matrix of i (example 1)

$$\text{Saliency}_{i^*} = \begin{pmatrix} 0 & 3 & 0 & 1 & 0 \\ 1 & 2 & 0 & 0 & 0 \\ 2 & 0 & 2 & 3 & \textcircled{3} \\ 0 & 0 & 3 & 0 & 2 \\ 3 & 0 & 1 & 2 & 1 \\ 0 & 1 & 0 & 0 & 0 \end{pmatrix}$$

(e)

Updated saliency matrix of i (example 2)

$$\text{Saliency}_{i^*} = \begin{pmatrix} 0 & 3 & 0 & 1 & 0 \\ 1 & 2 & 0 & 0 & 0 \\ 2 & 0 & \boxed{3} & 3 & 0 \\ 0 & 0 & 2 & 0 & 3 \\ 3 & 0 & 1 & 2 & 2 \\ 0 & 1 & 0 & 0 & 1 \end{pmatrix}$$

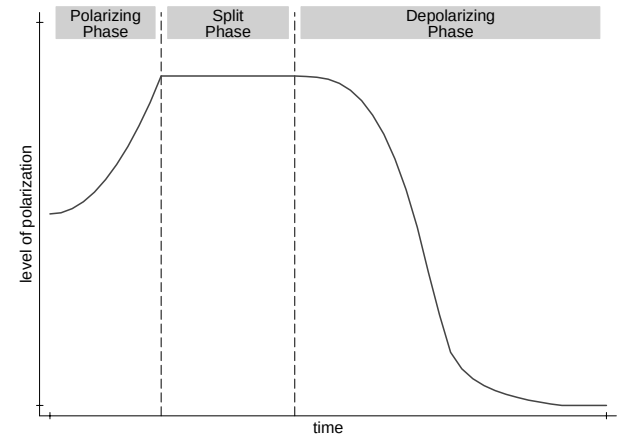
The Model

The Simulation Experiments

- **Parameters**
  - 20 team members
  - One issue (K=1)
  - Three demographic attributes (D=3)
  - There are 10 pro and 10 con arguments (P=C=10) and agents base their opinion on 4 of them (S=4)
- **We varied**
  - Faultline strength (f) between 0 and 1 in steps of .2 (see table)
  - Strength of homophily (h) between 1 and 5 in steps of 1
  - Initial correlation between opinion and the first demographic attribute (w) between no correlation (w=.5) and perfect correlation (w=1) in steps of .1
  - 500 runs (teams) per condition

The Model

What do we expect?



- Faultline strength results in group splits
- Splits only in the short run
- Opinions converge in the long run if faultline strength is not maximal.

Polarization is measured as the variance of pairwise opinion agreement across all pairs of agents in the population

The Problem

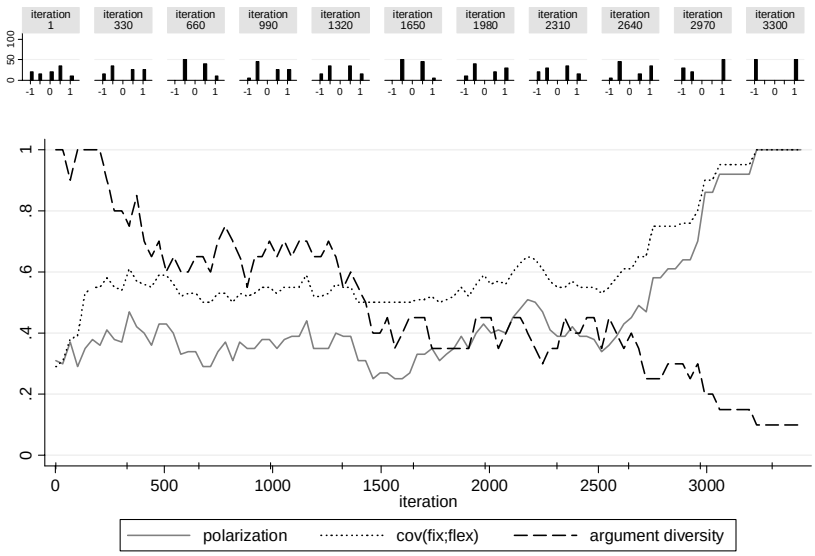
The Model

Results I:
Long vs. Short Term

Results II:
Positive Effects

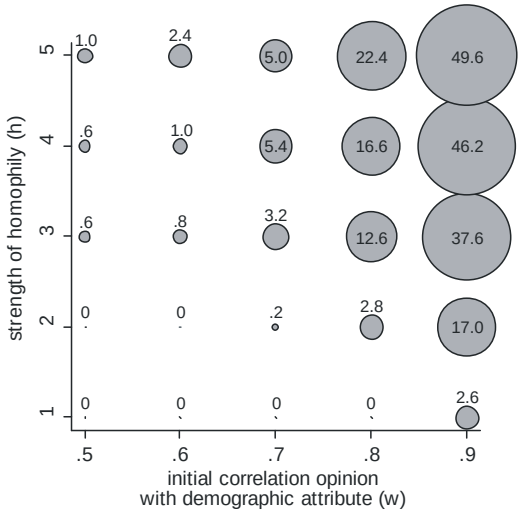
Results I: Long vs. Short Term

1. Maximal Faultline strength (*f*=1): a typical run



Results I: Long vs. Short Term

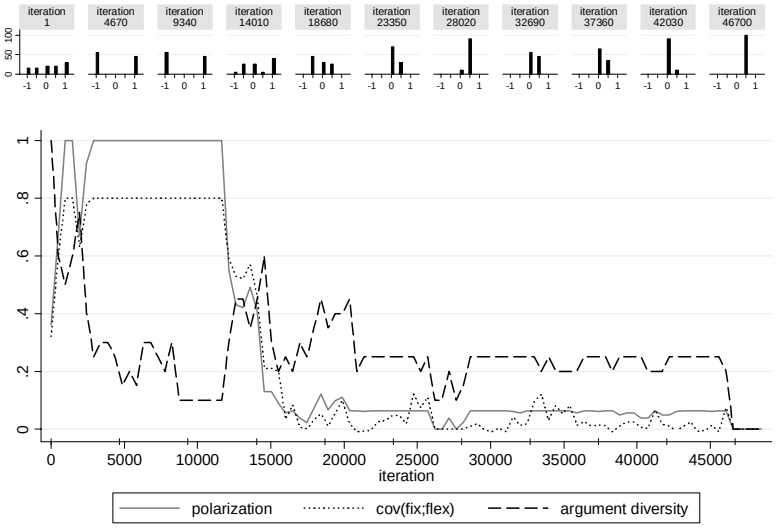
1. Maximal Faultline strength (*f*=1): Percentage of runs that split up



The higher *w* and *h* the more likely are group splits

Results I: Long vs. Short Term

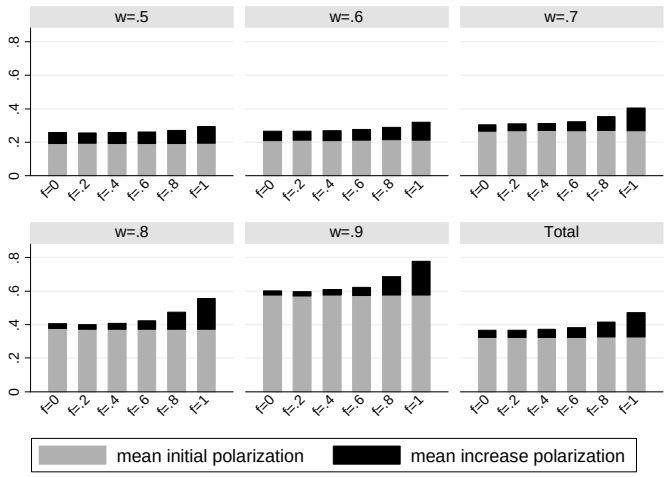
2. Teams with crisscrossing agents (*f*<1): a typical run



In the long run all runs with *f*<1 ended in consensus

Results I: Long vs. Short Term

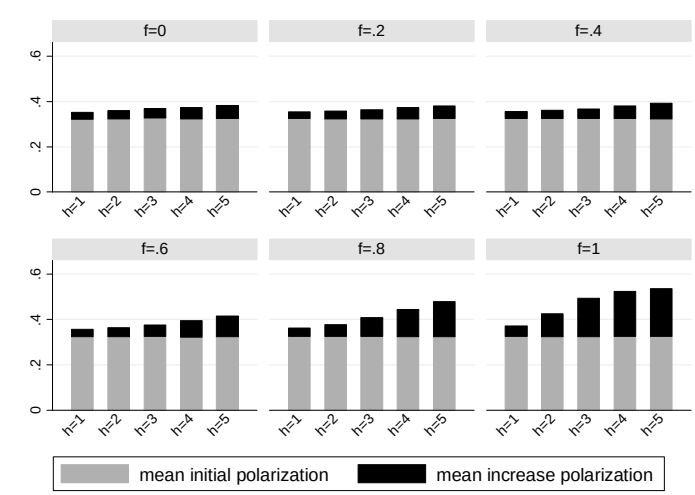
2. Teams with crisscrossing agents (*f*<1): maximal value of polarization



The stronger the faultline the stronger the tendency to split up (in the short run)

Results I: Long vs. Short Term

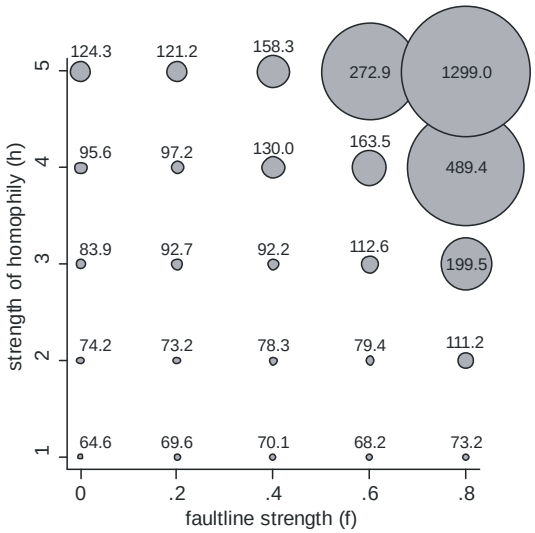
2. Teams with crisscrossing agents (*f*<1): maximal value of polarization



The stronger homophily the stronger the tendency to split up (in the short run)

Results I: Long vs. Short Term

2. Teams with crisscrossing agents (*f*<1): length of the split



The stronger the faultline and homophily the longer groups remain split up

The Problem

The Model

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Long vs. Short Term

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Positive Effects

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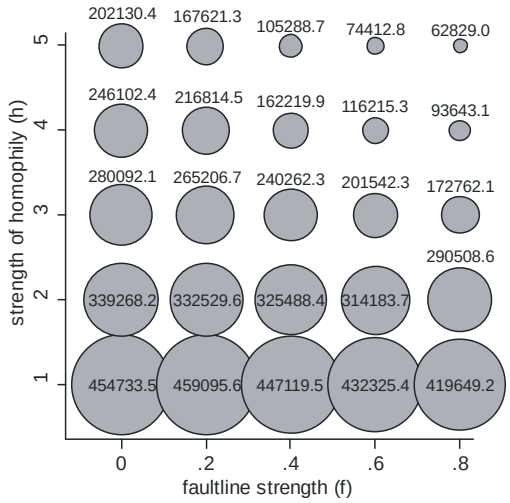
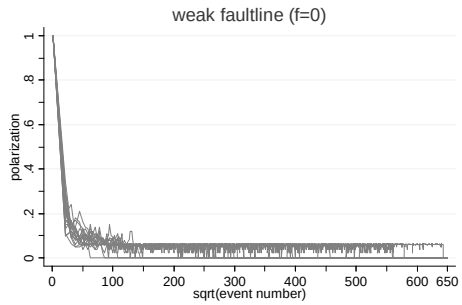
Positive Effects

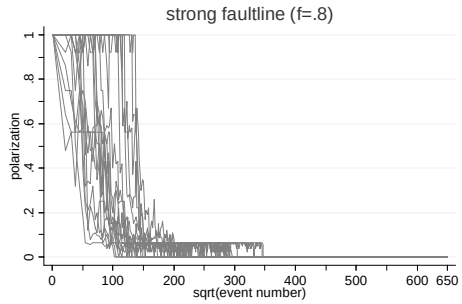
2. Teams with crisscrossing agents (*f*<1): length of the runs



The stronger the faultline and the stronger homophily the “faster” consensus is reached

Results II: Positive Effects

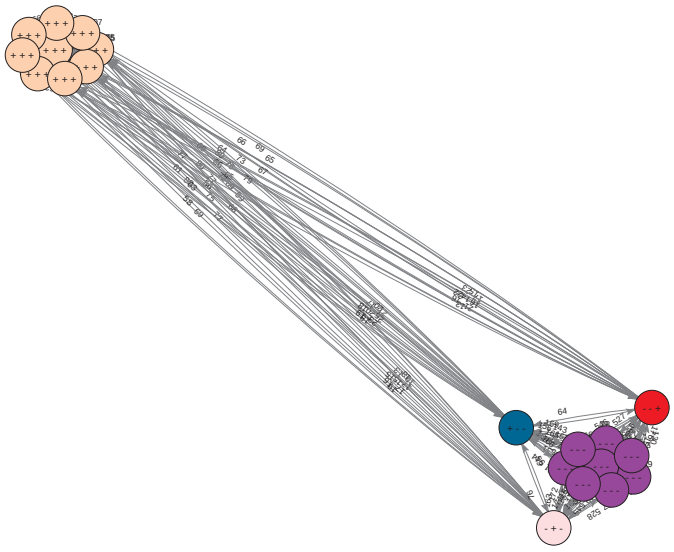




Groups with strong faultlines are faster at the end of the convergence process

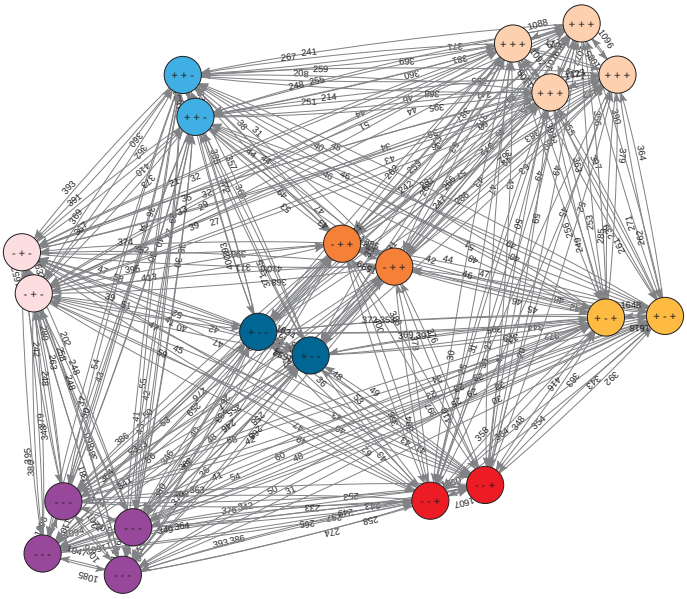
Results II: Positive Effects

Interaction network: strong faultlines (*f*=.8), strong homophily (*h*=5)



Results II: Positive Effects

Interaction network: stronger faultlines (*f*=.2), strong homophily (*h*=5)



Summary

- Consistency test of Lau and Murnighan's theory:
  - In teams with max. strong faultlines their mechanisms can predict group splits (only if strong homophily and initial correlation between opinion and demographic attributes)
  - Note that this is the only theory (we know) that can produce increasing opinion differences between subgroups that does not assume repulsion (tendency to increase opinion differences to dissimilar agents)
  - Also in teams with less strong faultlines groups may split up. But this happens only in the short run.
- Implications:
  - Also groups with strong faultlines will be cohesive in the long run (perhaps even faster).
  - However, in the short run their may be conflicts and low cohesion.
  - Managers have to make sure that in this phase there are no exogenous factors hindering crisscrossing agents from conciliating.

Thank You !