

The Effects of Problem Structure and Team Diversity on Brainstorming Effectiveness

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Idea generation at IDEO

“Brainstorming at IDEO is part art, part science. The rules are stenciled on the walls: Be Visual. Defer judgment. Encourage Wild Ideas. Build on the Ideas of Others. Go for Quantity. One Conversation at a Time. Stay Focused on the Topic.”

“Brainstorming is not just a good idea but an inexhaustible source of inspiration and fresh thinking.”

Website IDEO.com

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"I can't remember a single instance where a group produced a really creative idea,"

"You end up with the more pedestrian solution that you would have had had you not held the session, "

"If you stand back and think about [brainstorming], it's plainly inefficient," says Prof. Perkins. But, he says, "sometimes you take the brainstorming approach because you want everyone to feel they have a voice."

"These things are usually designed to give people the idea that they have input into decisions when the decisions have already been decided."

WSJ, June 13 2006

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Osborn 1957 "Applied Imagination"

- Brainstorming particularly effective if it builds on other people's idea and stimulate ideas based on other's arguments
- 4 rules for effective brainstorming

Management practitioner literature

(Kayser 1995, Fisher & Fisher 1998, Gundry & La Mantia 2001)

- Brainstorming as one method of idea generation
- How to make brainstorming sessions more effective

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... and its “divergence”

SOCIAL PSYCHOLOGY

“Nominal groups” outperform
“brainstorming groups”

- Production blocking
- Social / evaluation apprehension
- Free riding

Taylor et al. 1958,
Stroebe and Diehl 1987,
1991, 1994, Gallupe, 1991,
Paulus et al. 1996, 2000

ORGANIZATIONAL THEORY

“Brainstorming groups” outperform the
“nominal groups” (IN REALITY)

- Lack of brainstorming experience
- Lack of brainstorming “leadership”
- Disconnected from outcome
- Lack of social ties

Sutton and Hargadon
1996, Hargadon 2003

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Closely related literature

- Problem solving and search
(Weitzman 1979, Huberman & Loch 1996, Terwiesch & Loch 2004, Dahan & Mendelson 2001,...)
- NK model of complexity
(Kauffman 1993, Levinthal 1997, Rivkin 2000, Kauffman, Lobo & Macready 2000, etc.)
- Creativity and Idea Generation in Product Development
 - Terwiesch and Xu (2008)
 - Fleming (2006)
 - Girotra, Terwiesch & Ulrich (2008)

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- *When is brainstorming an effective tool for idea generation ?*
- *How does the problem structure and team diversity influence the effectiveness of brainstorming relative to nominal groups ?*

Problem structure

- Variance in performances
- Complex performance function (Huberman and Loch 1996; Mihm et al. 2003)
- Specialized / cross-functional problem?

Team diversity

- Prior experience with problem / reference point (Yetton and Bottger 1982, Wanous and Youtz 1986, Libby et al. 1987, Robins and Judge 2006)
- Functional expertise / knowledge about problem parameters (Dougherty 1992, Brown et al. 1998)

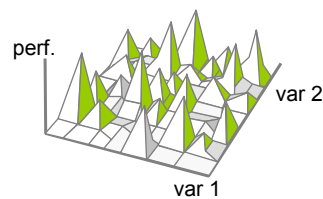
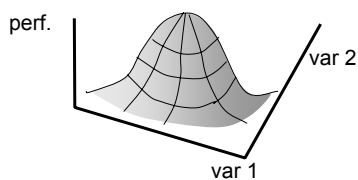
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- Ω : space of potential/feasible solutions
- w_i : factors describing feasible solution
 $w_i \in S = \{0, 1, 2, 3, \dots, S\}$
- $V(\vec{w})$: complex (unknown) solution performance function
- W_i : performance contribution of factor w_i potentially influenced by other factors

$$\vec{w} = (w_1, w_2, \dots, w_N) \in \Omega$$

$$V(\vec{w}) = W_1 + W_2 + \dots + W_N$$

$$W_i \text{ drawn from } F_i$$



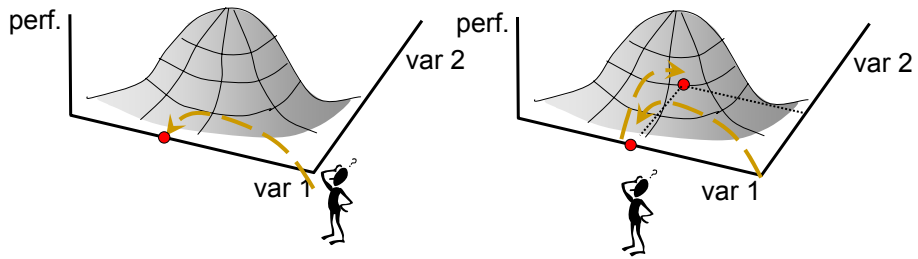
$W_i(w_i)$

interdependencies

$W_i(w_1, w_2, \dots, w_N)$

The Idea Generation Process

- Generate ideas for T periods
- New ideas build on / triggered by past ideas \rightarrow vary subset of w_i



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The Idea Generation Process

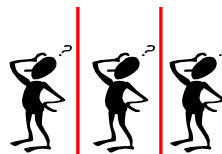
Brainstorming Groups



**“Building” on others’ ideas
but less contributors (M')**

(production blocking, evaluation apprehension)

Nominal Groups



“Building” on own ideas only

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- M team members (both in brainstorming or nominal groups)
- **Diversity**: similarity of starting points
- **Functional Knowledge**: specialized / cross-functional problem?
members can affect different subset of the factors w_i

Comparison:

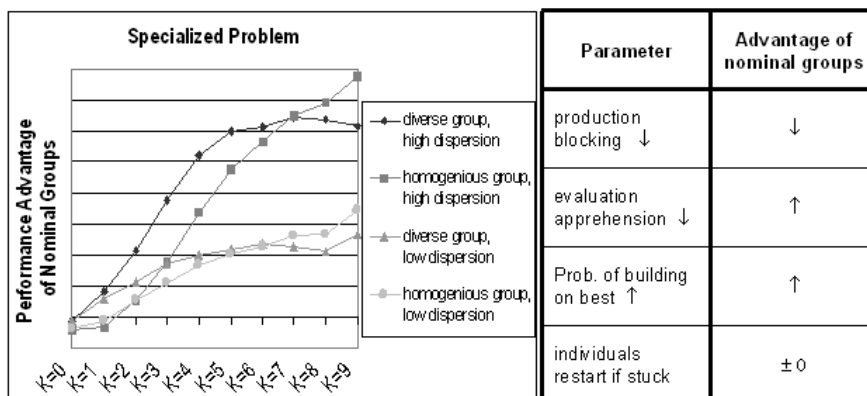
- V^{NG} : value of best solution found by all individuals in nominal group
- V^{BG} : value of best solution found by the brainstorming group
- $\Delta = E(V^{NG}) - E(V^{BG})$

Model specifications: $T=15, N=10, M=8, M^*=1, S=\{0,1\}, F_i: U[0,1]$ or exp. ($\lambda=2$)

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(1) Specialized problem

*Nominal group outperforms brainstorming group
Diversity and improvement potential increase advantage*

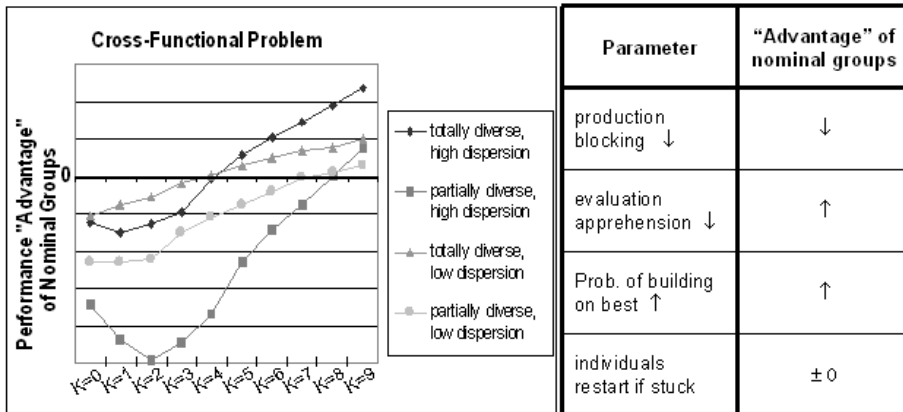


Plot

relative performance: nominal group – brainstorming groups
average across 100 landscapes and 100 runs within each landscape

(2) Cross-functional problem (M1=M2=4)

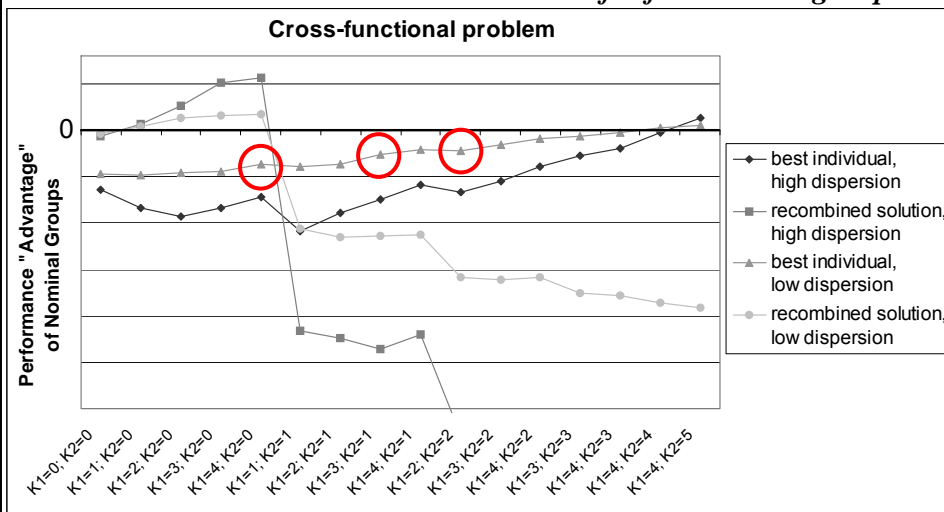
Relative advantage depends on problem structure and diversity
Improvement potential makes optimal choice more important



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(3) Modular problem structure

Brainstorming groups perform better for more modular problems
W/o interactions recombination can be useful for nominal groups



- Specialized problems: Advantage of nominal groups increases in production blocking, team diversity and improvement potential
- Cross-functional problems:
 - Brainstorming groups outperform nominal groups for problems with moderate complexity
 - Evaluation apprehension not necessarily a drawback: may help brainstorming if focus is on quality of ideas (rather than quantity)
 - Include members with diverse organizational experiences for nominal groups to benefit most from diversity
 - Important to understand the source of complexity: Brainstorming groups perform better for more modular problems.

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Questions ?
Suggestions ?

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