

Brainstorming

Supercomputing Challenge

Summer Teacher Institute

July 22, 2011

Origin of Brainstorming

Osborn (1939)

Method for creative problem solving

Frustrated by employee's inability to develop creative ideas individually for ad campaigns.

Began hosting group-thinking sessions and discovered a significant improvement in the quality and quantity of ideas produced by employees

Published book - Applied Imagination,

Osborn's Method

Two principles for “ideative efficacy”

Defer judgement

Reach for quantity

Method

Focus on quantity

Withhold criticism

Welcome unusual ideas

Combine and improve ideas

Problems with Brainstorming

Free riding

Evaluation apprehension

Blocking

Variations

Nominal group technique

Write ideas anonymously, vote as a group

Group passing technique

Each person writes down an idea, passes it to next who adds to it, continue until comes back to original person

Team idea mapping

Variations (cont)

Directed brainstorming

Each participant writes idea on sheet of paper, swaps randomly, create new idea that improves idea

Individual brainstorming

Free writing, free speaking, word association, mind map

Question brainstorming

Brainstorm questions to problem

Scoping a Project (Focusing)

Occam's Razor

principle that suggests we should *tend towards simpler theories until we can trade some simplicity for increased explanatory power*

Do one part – not all

Perhaps the first critical part that shows it is feasible

Staged project or multi-year project

Brainstorming Exercise

Anonymous input to idea prompts on paper

Map onto white board into groupings

Computer Science

Behavioral Sciences(includes Business, Finance and Social categories)

Sciences

Engineering

Idea Prompts (Word Association)

Water related interest?

Personal Interests?

What college majors are you interested in?

Recent news articles?

Community issue or problem?

Write a program or use a program?

Opposites? Turn it around (drought instead of water, no disease

Google Ideas

Google “Computational <keyword>”

Idea Prompts (field specific)

In Computer Science

All of Knuth's 4+ volume Art of Programming changed n^2 algorithms to $n \log n$ for serial computing

Need to be parallelized and $n \log n$ algorithms are much harder to parallelize than n^2

$N \log n$ algorithms tend to be trees, binary searches, sorts, hashes (can you merge two trees or sorts)

Science

What are the patterns? (data – modeling results)

What are the influencing factors?

What happens at extremes?

Sensitivity analysis?

Real data inputs?

Engineering

Problem-driven

What are the right tools?

Is there a hand-calculation or simple calculation that can be improved with a computer calculation?

Real world data or design data available?

Monte Carlo or deterministic?

Behavioral (Social Sciences or

What techniques are available?
Financial)

Prisoner's dilemma

Game theory

What data is available? (e.g. demand response data, etc)

Business (Optimization Methods)

Problem-driven

What optimization techniques to use?

Is it linear? (\$30/widget)

Non-linear?

NP hard (complex beyond computing – chess)

- Search for a near-optimum