Session #7

Pugh Concept Selection

Controlled Convergence

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Controlled Convergence

- This is Pugh’s vision of the conceptual phase of design
- Takes us from a specification to a concept
- Convergent and divergent thinking equally important
Plan for the Session

• Notes on exam #1
• Summary of last session -- QFD
Brainstorming (ideas from IDEO)
• Pugh Concept Selection
  – What is it for?
  – How do you use it?
  – Critique
• Next steps

By the general manager of IDEO -- America’s top design firm.

This book describes the processes and practices that keep IDEO creative and vibrant.
IDEO Brainstorming

• A group problem solving technique that involves spontaneous contribution of ideas from all members of the group
Composing the Brainstorming Group

• Get a range of expertise and perspectives
  – Software / hardware
  – Marketing, engineering, maintenance, sales
  – Engineers, scientists, linguists, artists
• Include the client if possible
• Enough people to maintain momentum
• Small enough that all are engaged
  – 5 to 7 people
Preparing for the Brainstorm

• Understand the problem
• Gather background info
• Set up the room
  – Everyone around one table
  – Stacks of 8.5X11 plain paper
  – Whiteboards or easels and markers
  – Props (hardware, technologies)
  – Food and drink

The House of Quality!!
The Five Rules of the Brainstorm

• Defer judgment
• Build upon the ideas of others
• One conversation at a time
• Stay focuses on the topic
• Encourage wild ideas

What did Pugh say about this?
Recording Ideas

- Record EVERY idea
- Make a good picture of the idea
  - This is helpful for the Pugh matrix later
- Headlining (choose a descriptive name)
- Shoot for a large number (100 in one hour)
Some Brainstorming Tricks to Try

- Analogy (nature, other technologies, …)
- Inversion

- Combination
- Checklists (TRIZ is essentially a well designed checklist, more in session #8)
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Controlled Convergence

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## Evaluation Matrix

<table>
<thead>
<tr>
<th>Concept</th>
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</tbody>
</table>
The First Run

• Generate multiple solutions to same problem spec.
• Depict the solutions (sketches)
• Form the matrix
• Choose criteria (and **clarify** them)
• Choose datum (pick one of the ‘best’ solutions)
• Insert comparisons (+, S, -), form sums thereof
• **Look at strongest concepts, try to reverse negatives (combine with complementary concepts)**
• Look at weaker concepts, try to improve them
• **Eliminate the weakest** remaining concepts
The Second Run

• Strengthen the best concepts from first run
  – This is substantial engineering work
  – More detailed descriptions will emerge
  – Note the plural – develop multiple concepts
• Expand evaluation criteria
• Choose new datum (pick one of the ‘best’ solutions)
• Insert comparisons (+, S, -), form sums thereof
• **Seek agreement among team on the best concept**
• Further phases may be required to obtain convergence
• “…experience has shown that, almost without exception, the results of Phases I and II will be confirmed…”
Some Challenges

• "people who have a lot of experience … exhibit an impatience ‘to get on with it’ and may consider that the procedure holds them back…”

• "strong willed individuals who have a lot of experience and whose initial concepts have not emerged in the final selection … commence a defense based on emotion, experience, and bluster…”
Role of the Facilitator

• Controls the flow / pace of the session
• Records the results (creates the matrix)
• Maintains a tight discipline on the participants
  – Comparison to the datum concept
  – Preventing tangents
  – Encourages clarification of criteria
  – Encourages clarification of concepts
• Seeks opportunities for divergence (hybrids)
What is the Pugh Matrix for?

The Pugh matrix is for

- Structuring and representing an evaluation procedure
  - Serves as common visual
  - Provides a discipline
  - Helps break down self-sealing behavior
  - Encourages real teamwork
- Convergence
  - Eliminates weaker ideas
  - Retains a set of strong concepts
- Divergence
  - Helps to identify opportunities for combination

The Pugh matrix is NOT for

- Automatic decision making
  - “the scores or numbers … are for guidance only and must not be summed algebraically.”
  - “it avoids the rigidity and false confidence of rating/weighting matrices”
- Completely controlling the process
  - “… stimulates creative unconstrained thinking due to its lack of rigorous structure”
- Trade studies
  - More on this today

Summary

• QFD helps with the front end
• Then a large number of concepts are needed
• Pugh controlled convergence helps with the convergent and divergent process
• Enhances creativity, communication, and builds consensus
• Don’t over emphasize numbers
• Do be aware of how product attributes combine