

Abstraction & Synthesis

Abstraction

- Break into sub-problems/functional parts -
- Generalize the problem to see the range of possible solutions
 - General purpose or function
 - Remember to focus on function first
 - Principles/approaches (can you come up with all possible categories)
 - Context
- Possible models for sub-problems

Wind Chime configuration (class example problem)

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| <p>Conceptual aspects of a chime (subdividing the problem)</p> <ul style="list-style-type: none"> • Source of ringing • Way to start ringing (strike) • Way to drive the strike • Configuration • Suspension | <p>Develop as many configurations as possible</p> <p>Source:</p> <ul style="list-style-type: none"> tubes, squares, channels, strings, pipes (woodwind) • Ways to start ring – hammer, hit together, spring release, pluck • Ways to drive strike – sail, sails, tube ends, sock • Configuration <ul style="list-style-type: none"> Vertical, horizontal, circle, square ... ring, multiple rings, concentric, crossed |
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Synthesis (assign quick case studies)

Basic Idea → Bring concepts together e.g., Disposable Battery Testers

- | <u>Simple Source</u> | <u>Example</u> |
|----------------------------|---------------------------------|
| • Discovery by Accident(?) | Teflon (pp. 283) |
| • Bionics (nature analogy) | Velcro (p. 287) |
| • Analogies (Synectics) | Satellites and Yo-Yo's (p. 291) |
| • Fresh Perspective | Elevator (p. 294) |
| • What's wrong with it? | 7.6 What's wrong with our toast |
| • Inversion | 7.9 Jokes for trash |

Basic Concept

- Bringing pieces together to form something new
- Disposable Battery Testers (p. 277)

Specific Sources

- Design by Accident
 - Teflon (p. 283)
 - Slinky (p. 283)
 - CorningWare
 - 7.5 Rubber Vulcanization
 - "Chance favors the prepared observer" Pasteur
- Fresh perspective
 - Elevator Concept (p. 294)
 - Listen!!

Analogies (Synectics)

- Bionics
 - Velcro (p. 287)
 - Vortex noise and Owl's Wings
 - How does nature do it – can we
- Inversion
 - 7.9 Jokes for Trash
- General
 - Satellites and Yo-Yos (p. 291)
 - 7.7 Running Shoes with Waffle Soles

Brainstorming – Basic Rules

- Separate idea generation and idea evaluation -
 - Initial session on generation
 - Allow identity of idea source to be lost (at least temporarily)
 - Evaluation later (but do do it)
- You want stupid/crazy ideas
- Consciously attempt to build on each others ideas
- Relax constraints in idea generation
- Design so everyone speaks
- Leader/facilitator goes last

Brain Writing

- Done in writing instead of verbally