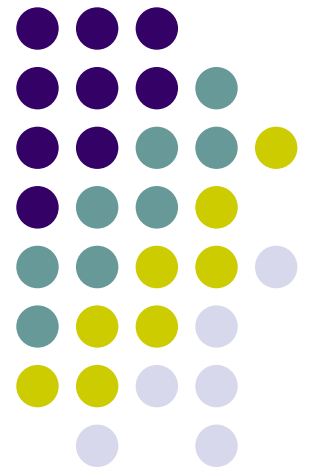
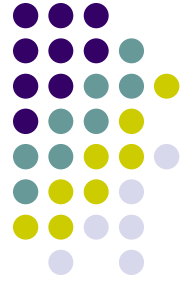


Concept Generation

Thomas A. Roemer

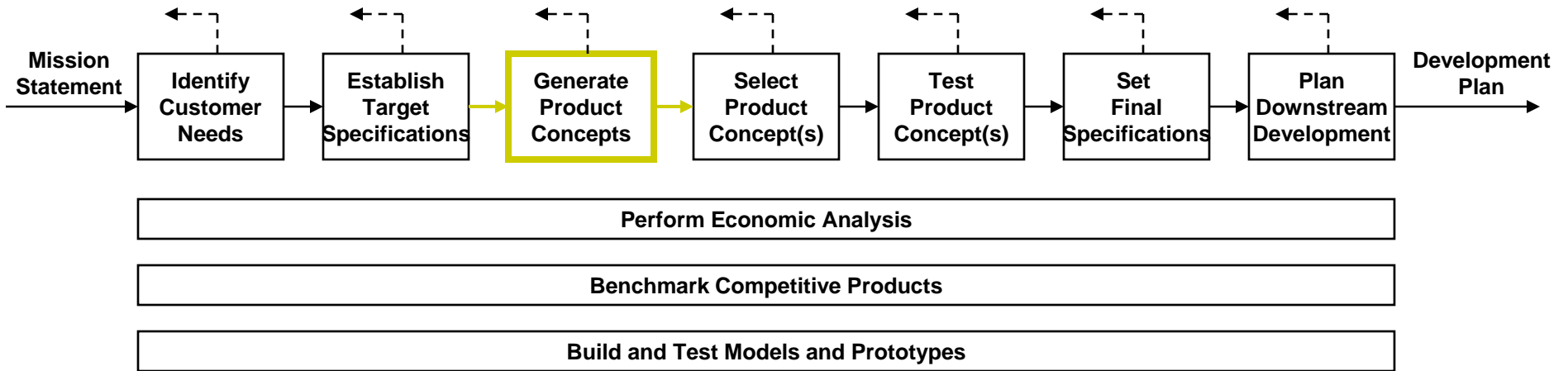
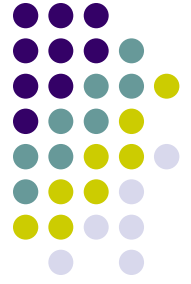




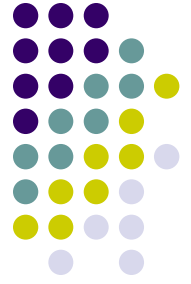
*... the best way to get a good idea
is to get a lot of ideas...*

Linus Pauling

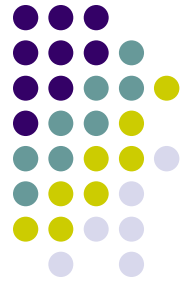
Concept Development Process



Concept Generation Exercise: Vegetable Peelers

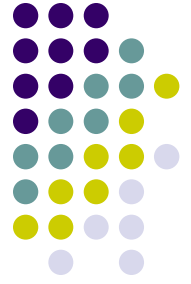


Vegetable Peeler Exercise: Voice of the Customer



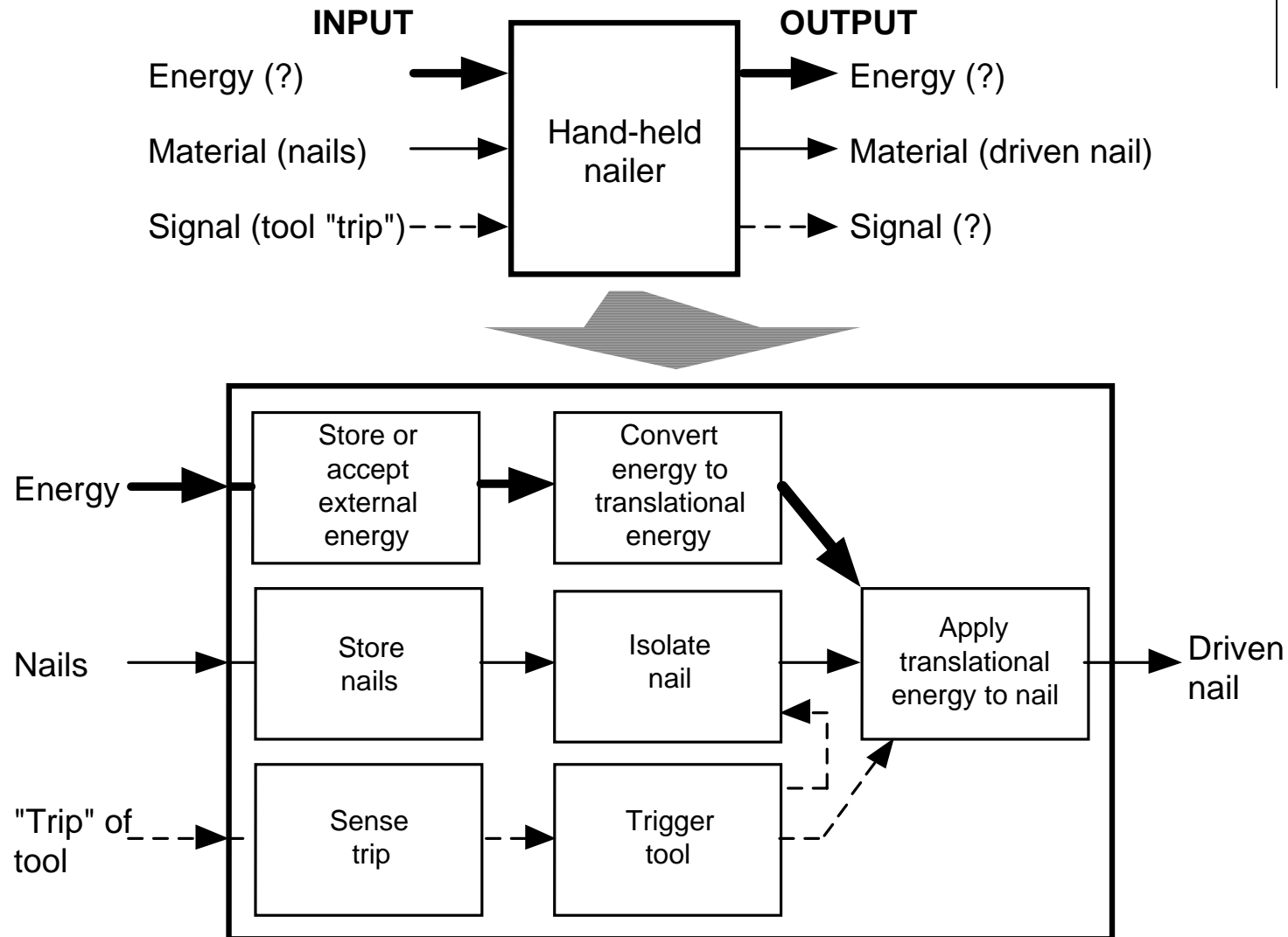
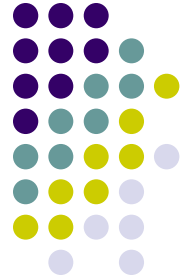
- "Carrots and potatoes are very different."
- "I cut myself with this one."
- "I just leave the skin on."
- "I'm left-handed. I use a knife."
- "This one is fast, but it takes a lot off."
- "How do you peel a squash?"
- "Here's a rusty one."
- "This looked OK in the store."

Vegetable Peeler Exercise: Key Customer Needs

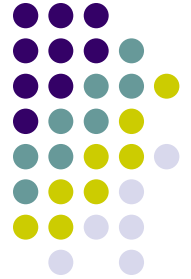


1. The peeler peels a variety of produce.
2. The peeler can be used ambidextrously.
3. The peeler creates minimal waste.
4. The peeler saves time.
5. The peeler is durable.
6. The peeler is easy to clean.
7. The peeler is safe to use and store.
8. The peeler is comfortable to use.
9. The peeler stays sharp or can be easily sharpened.

Problem Decomposition: Function Diagram

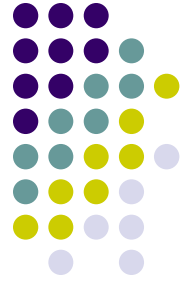


External Search: Hints for Finding Related Solutions



- Lead Users
 - benefit from improvement
 - innovation source
- Benchmarking
 - competitive products
- Experts
 - technical experts
 - experienced customers & sales staff
- Patents
 - search related inventions
- Literature
 - technical journals
 - trade literature

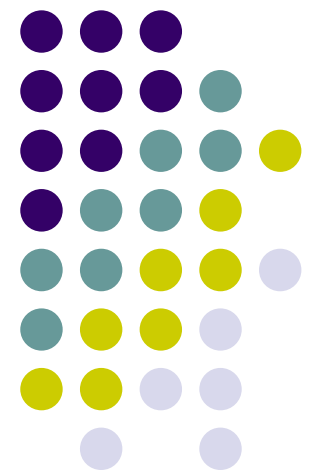
Internal Search: Hints for Generating Many Concepts



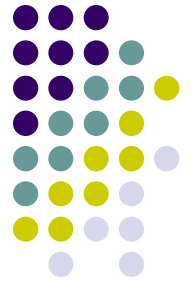
- Suspend judgment
- Generate a lot of ideas
- Infeasible ideas are welcome
- Use graphical and physical media
- Make analogies
- Wish and wonder
- Use related stimuli
- Use unrelated stimuli
- Set quantitative goals
- Use the gallery method
- Trade ideas in a group
- Solve the conflict

An Excursion to TRIZ

*Theory of Inventive Problem
Solving*

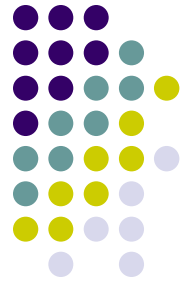


The first 13 (of 39) TRIZ Metrics



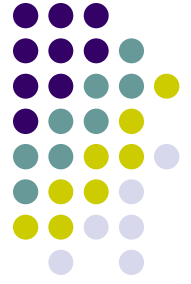
1. Weight of Mov. Obj.
2. Weight of Stat. Obj.
3. Length of Mov. Obj.
4. Length of Stat. Obj.
5. Area of Mov. Obj.
6. Area of Stat. Obj.
7. Volume of Mov. Obj.
8. Vol. of Stat. Obj.
9. Speed
10. Force
11. Stress
12. Shape
13. Stability

The first 19 (of 40) TRIZ Principles



1. Segmentation
2. Taking out
3. Local quality
4. Asymmetry
5. Merging
6. Universality
7. "Nested doll"
8. Anti-weight
9. Preliminary anti-action
10. Preliminary action
11. Beforehand cushioning
12. Equipotentiality
13. 'The other way round'
14. Spheroidality - Curvature
15. Dynamics
16. Partial or excessive actions
17. Another dimension
18. Mechanical vibration
19. Periodic action

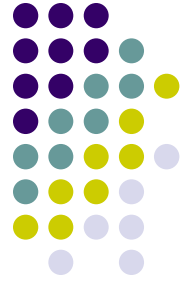
Child Car Seats: Volume vs. Shape



METRICS	Shape															
Volume	7, 29															

DESIGN
PRINCIPLES

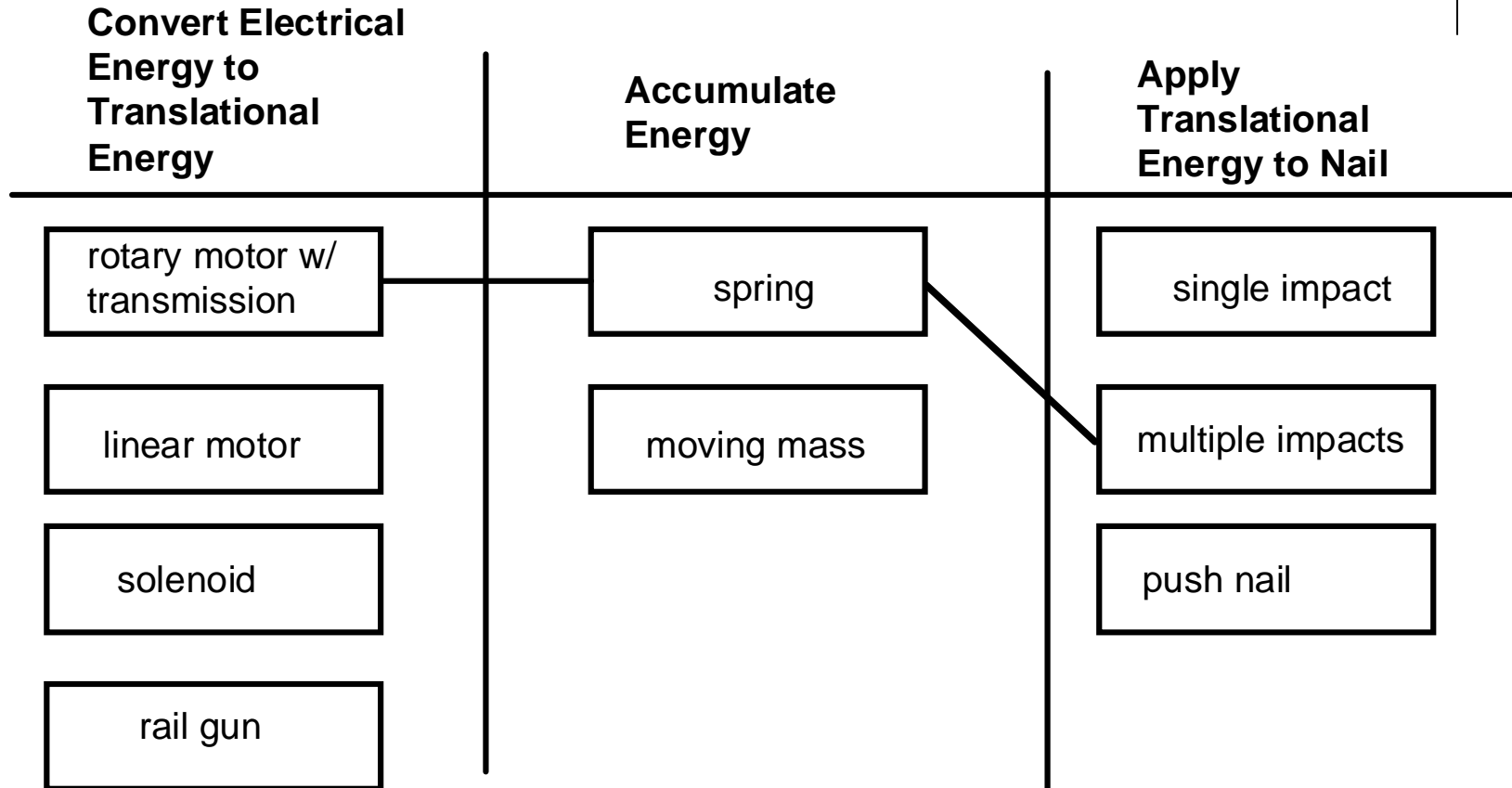
- 7. "Nested Doll"
- 29. Pneumatics and Hydraulics

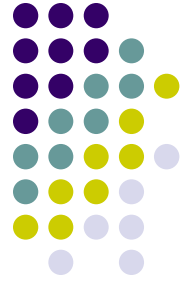


Principles 7 & 29

- 7: “Nested Doll”
 - Place one object inside another
 - Pass one part through a cavity in the other
- 29: Pneumatics & Hydraulics
 - Use gas and liquid parts of an object instead of solid parts (e.g. inflatable, filled with liquids, air cushion...)

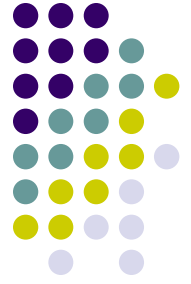
Systematic Exploration: Concept Combination Table





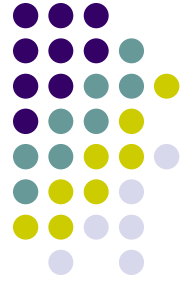
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is to get a lot of ideas...*

Linus Pauling



Team Processes

- Suggestion: Assign a manager for each assignment.
- Be inclusive of all team members.
- Try to meet once or twice a week.
- Team meetings are for sharing results, reaching consensus, making decisions, and assigning the work.
- The “real work” gets done outside of the meetings.
- Many teams are meeting at noon before class Tuesdays and Thursdays.



Suggested Reading

- TRIZ
 - Genrich Altshuller:
“And suddenly the inventor appeared”
- Function Analysis
 - Kaneo Akiyama
“Function Analysis”
 - Gerhard Pahl and Wolfgang Beitz
“Engineering Design”