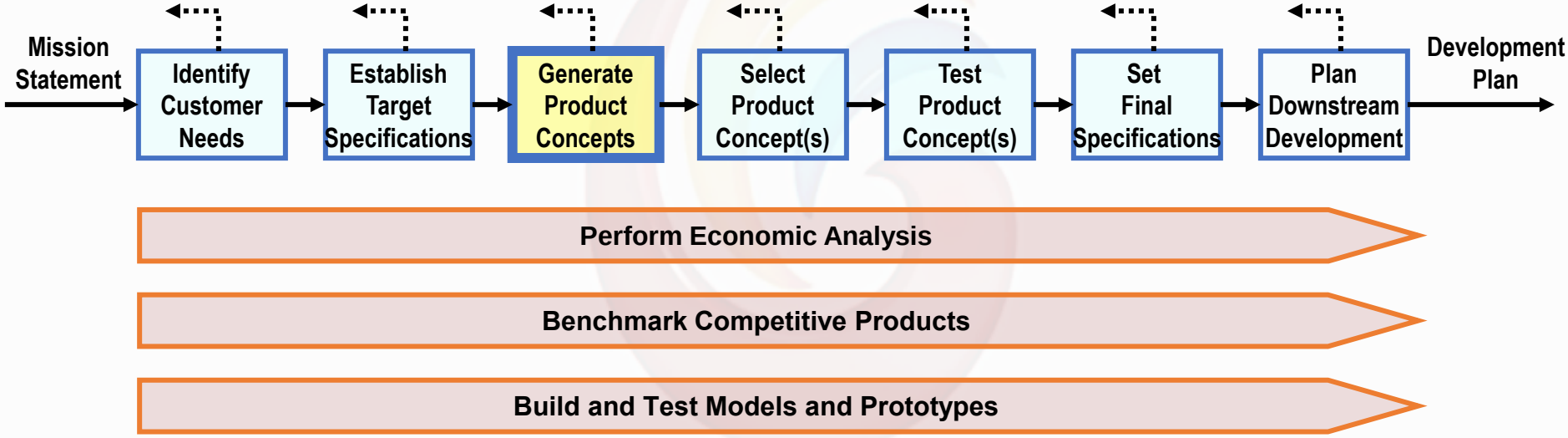
Concept Generation

Concept Generation

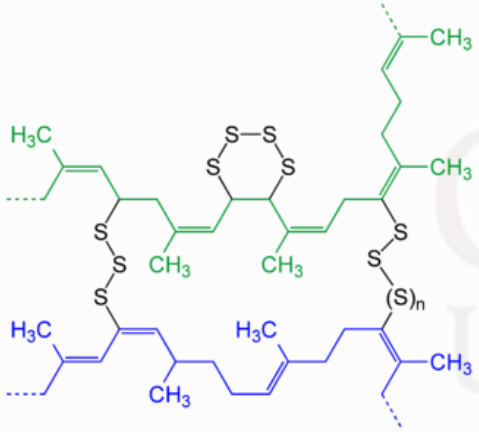
Concept Development Process



Invention, innovation, and creativity

Invention

Creation of something that didn't exist before



Innovation

Useful application of an invention or combining existing ideas in a new and useful way

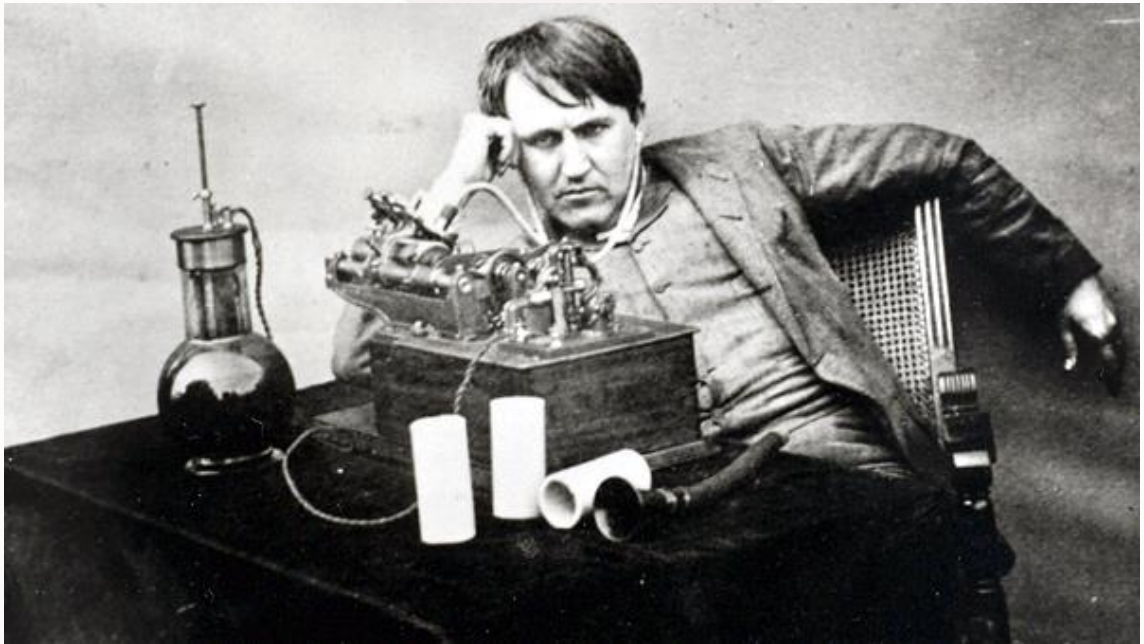
Creativity

Application of imagination to a problem (although not always practical)

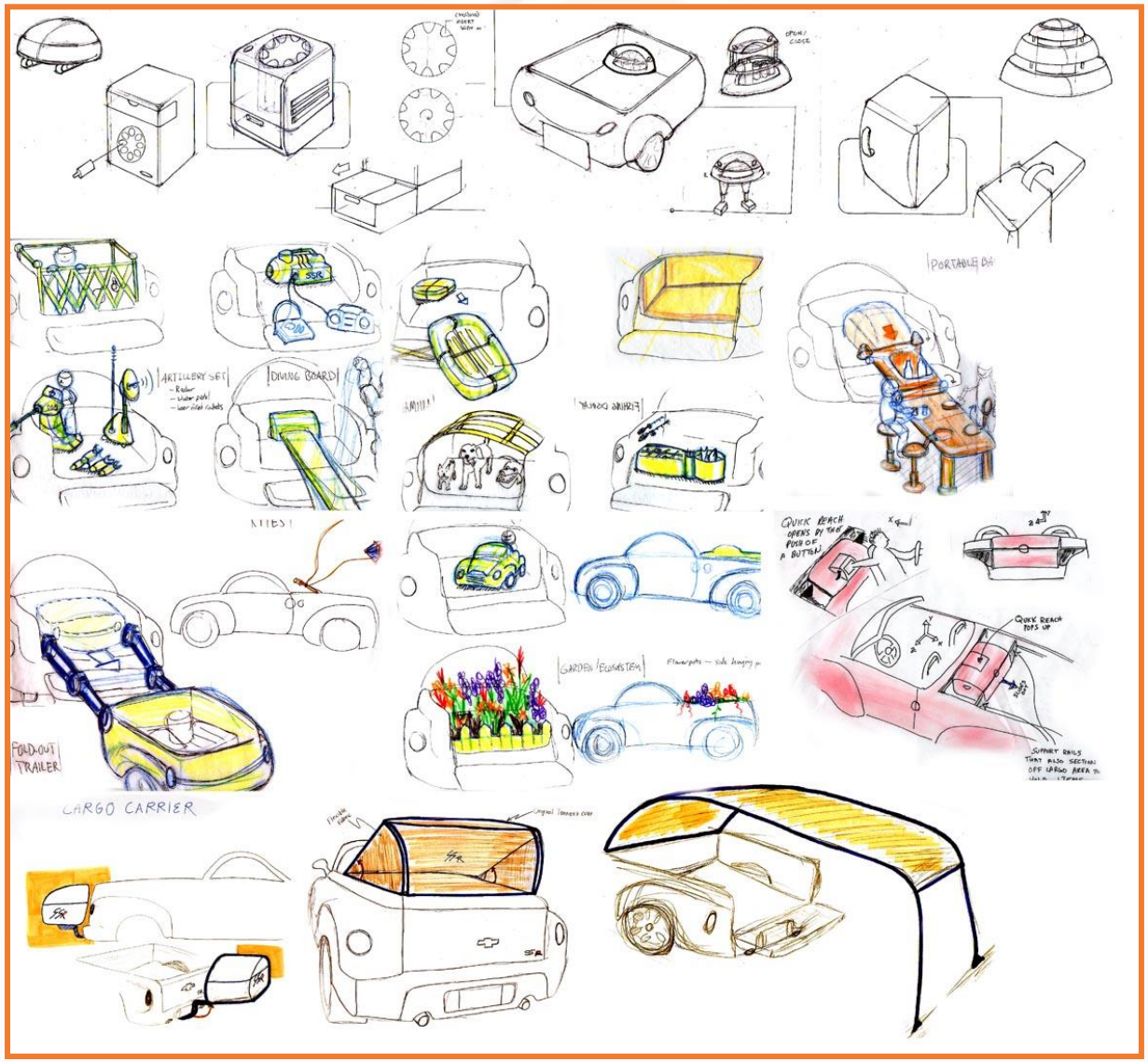
Great Ideas

“To have a great idea … have a lot of them.”

Thomas Edison



Why are some people able to generate lots of ideas?



Sources of Innovation

"Creativity is just having enough dots to connect …

… to connect experiences and synthesize new things. The reason creative people are able to do that is that they've had more experiences or have thought more about their experiences than other people.”

Steve Jobs

Developing Ideas and Solutions:

External + Internal Search

External Search:
Finding Existing and Related Solutions

Patents

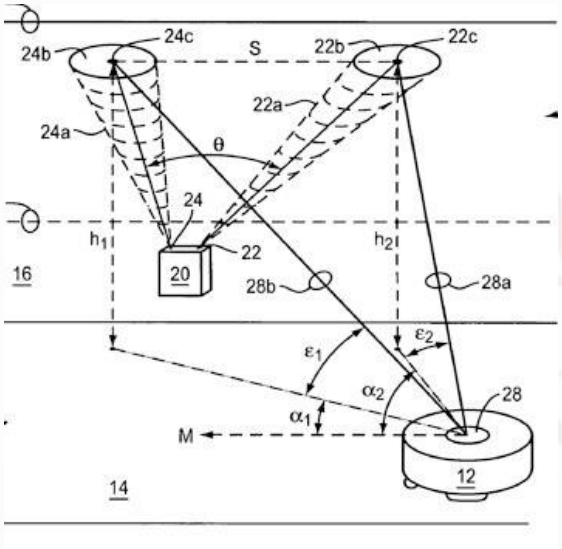
- Search
- Licensing

Market

- Benchmarking
- Competition

Users

- Lead users
- Extreme users

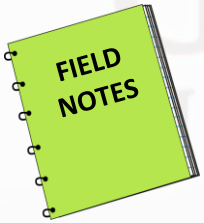


Internal Search:
Brainstorming to Explore the Solution Space

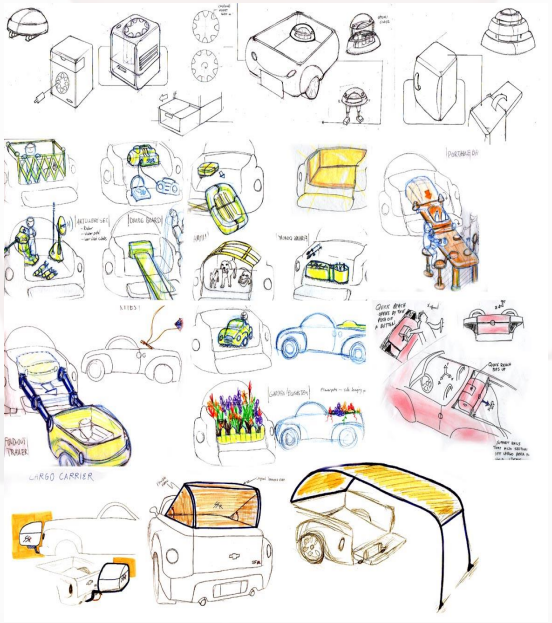
Stimulation + **Connection** + **Transformation**

- Related stimuli
- Unrelated stimuli

persona



- Build on ideas
- Gallery method



- Refinement
- SCAMPER method

Substitute
Combine
Adapt
Modify/Distort
Put to other purposes
Eliminate
Rearrange/reverse

Group Creativity (Brainstorming)

Some Common Rules

- Defer judgment of ideas
- Build on the ideas of others
- Encourage wild ideas
- Express ideas visually
- Stay focused on the topic
- One conversation at a time
- Use stimuli related to the topic

Setting It Up

- Advance prep
- Stimulating space
- 4 to 8 people
- Paper and markers
- White boards
- Coffee and snacks
- Skilled facilitator

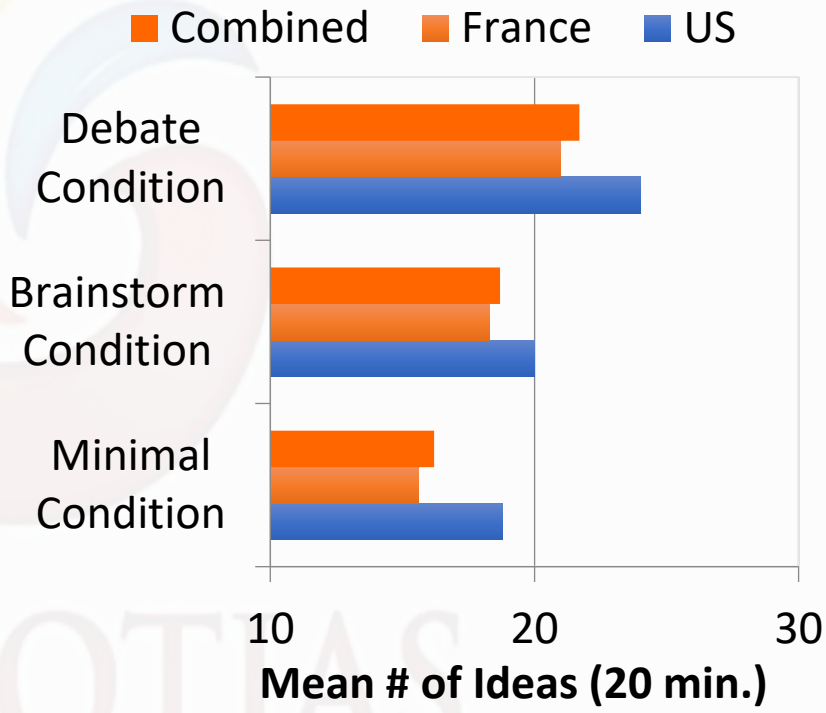
Research on Brainstorming and Creativity

Generating Ideas and Group Creativity

Brainstorm = "using the brain to storm a creative problem—and doing so in commando fashion, with each stormer attacking the same objective."

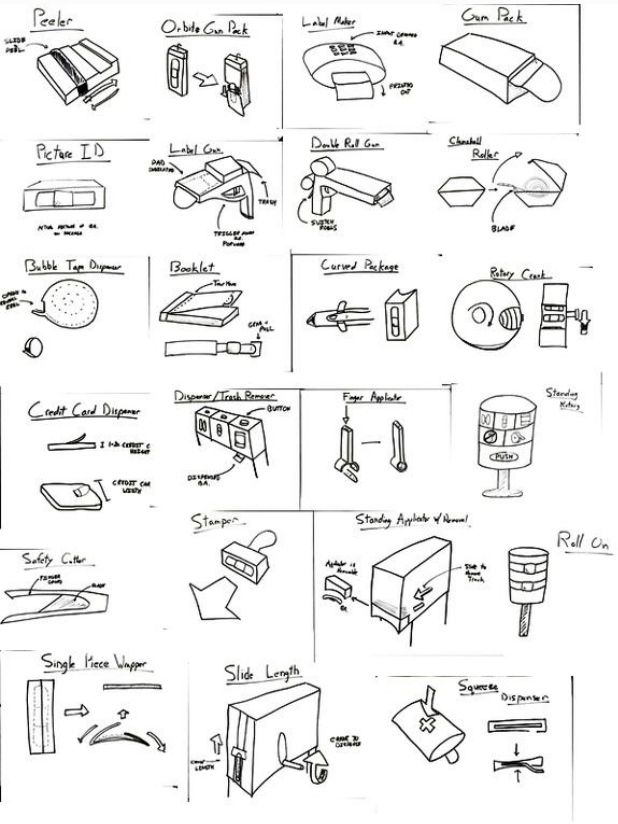
Ref: Alex Osborn, *Your Creative Power – How to Use Imagination*, New York: Scribner & Sons (1948)

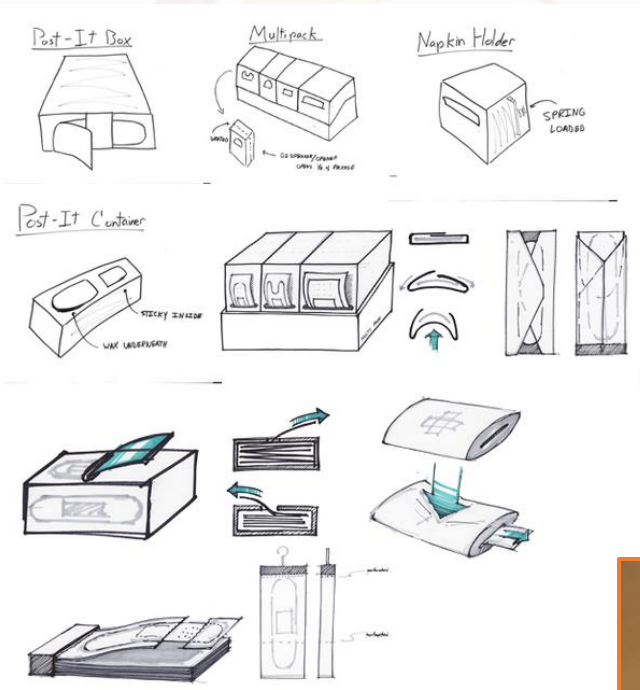
Value of Dissent and Debate in Group Creativity

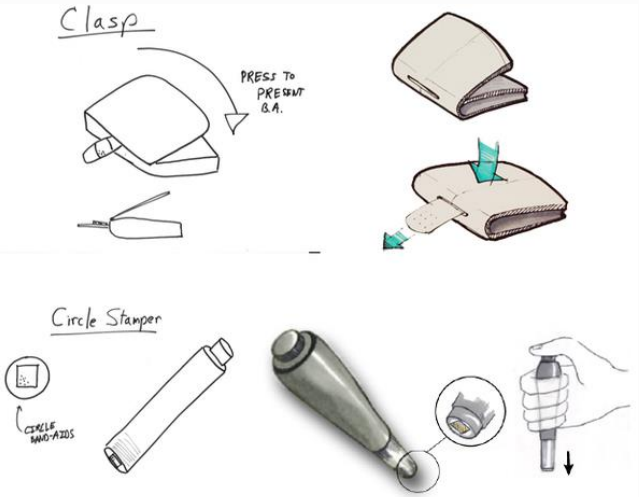


Ref: Charlan Nemeth, et al., "The Liberating Role of Conflict in Group Creativity", Eur. J. Soc. Psychol. (2004)

Concept Sketches





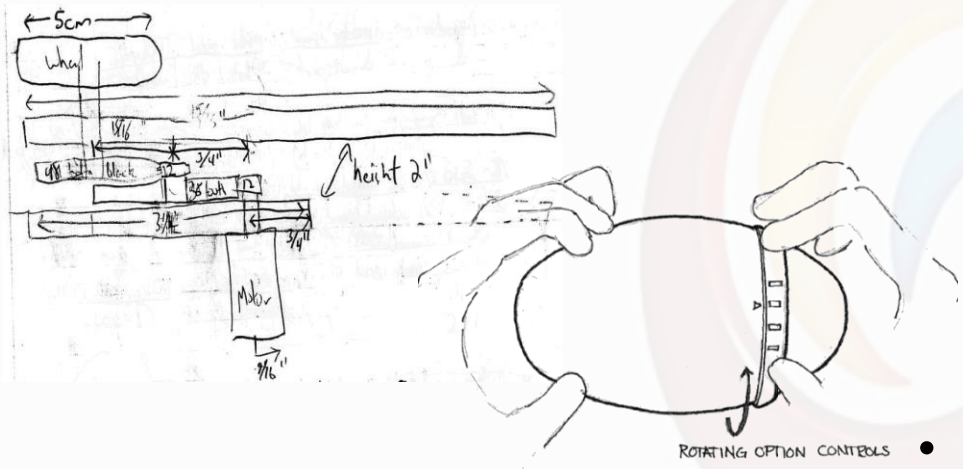


Sketch Modeling

http://www.onehundred.co

Research on Expression and Creativity

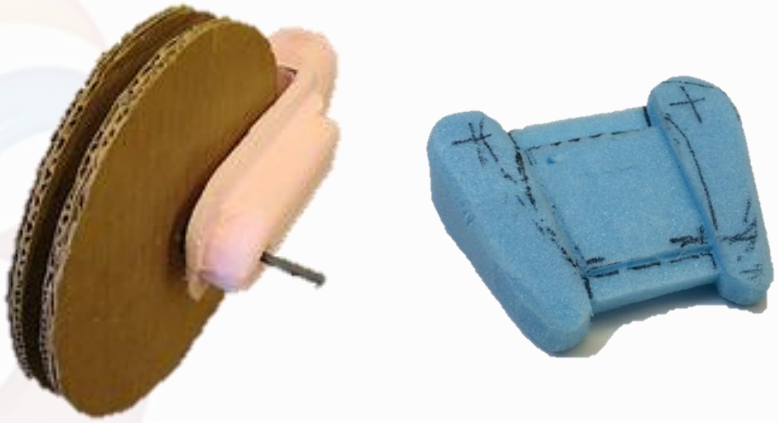
Make Plenty of Sketches – *Even if you can't sketch well*



- Spatial reasoning is challenging
- Words are inherently inefficient
- Sketches often work better
- Sketch quality is not so critical – just express the key concept

Ref: MC Yang (2009) "Observations on Concept Quantity and Sketching in Design" *Research in Engineering Design*

Build Sketch Models – *The sooner the better*



- Quick, simple, physical models
- 3D using foam, clay, cardboard
- Very helpful to understand form, user interface, spatial relations
- Earlier modeling is linked to better design outcomes

Ref: A Häggman, T Honda, MC Yang (2013) "The Influence of Timing in Exploratory Prototyping and Other Activities in Design Projects" ASME Design Eng'g Tech Conf.

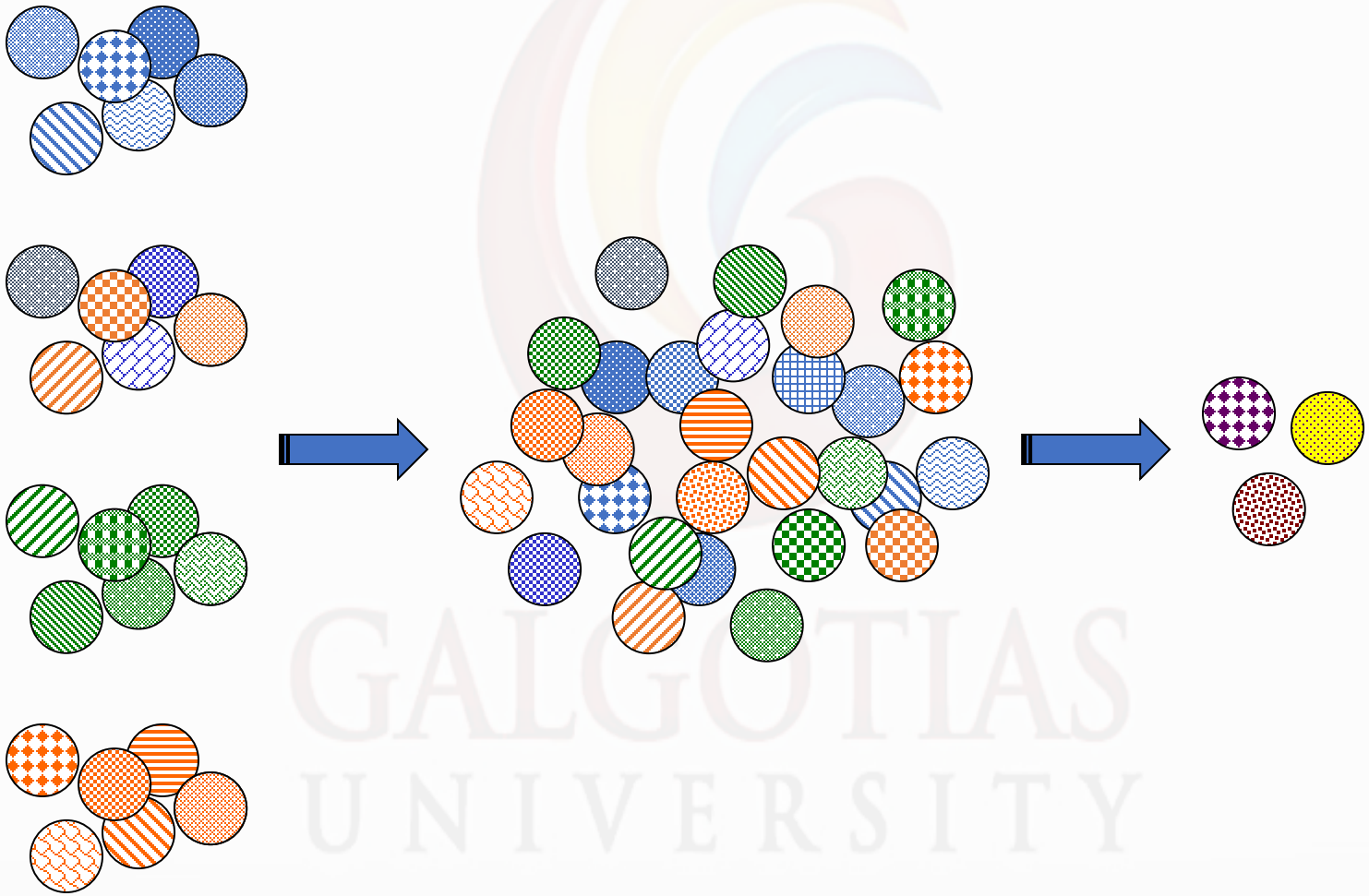
Research on Space and Evaluation

Getting away from the office and into a new space *increases quantity of ideas.*

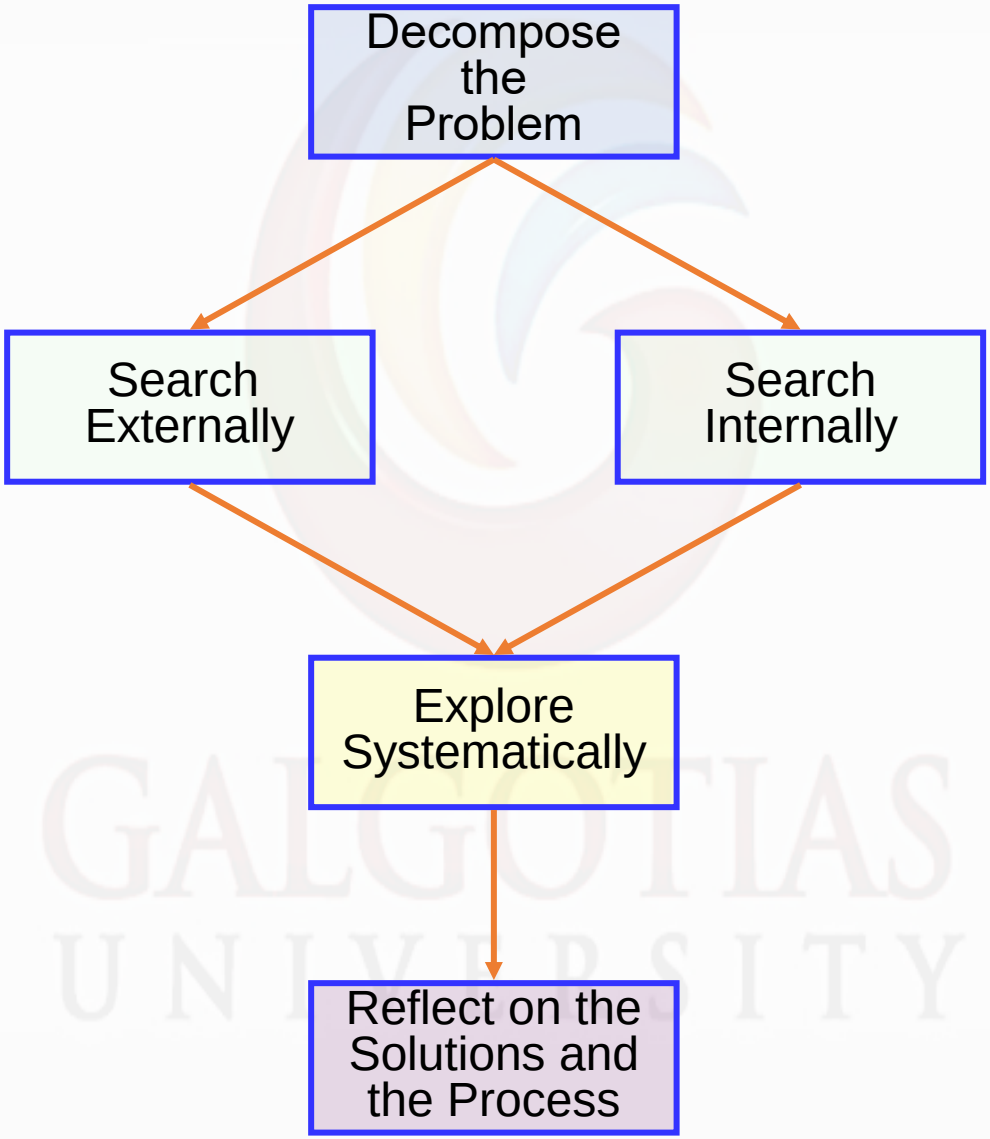
We judge ideas as more creative if they come from *outside our organization*.

Ref: Mueller, Wakslak, Krishnan (2014) "Construing Creativity: The How and Why of Recognizing Creative Ideas" *Journal of Experimental Social Psychology*

Individual + Group Creativity

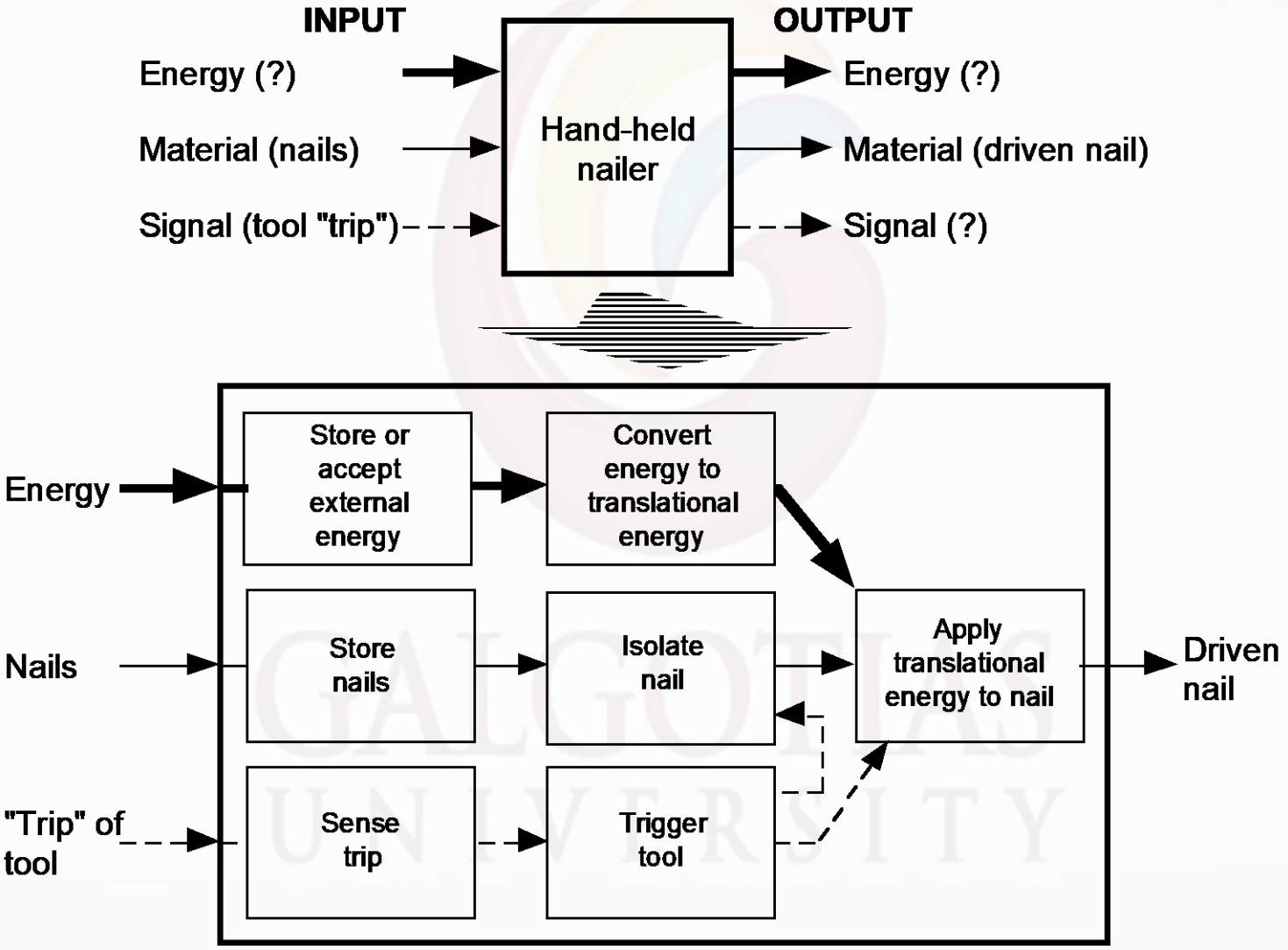


Concept Generation Process



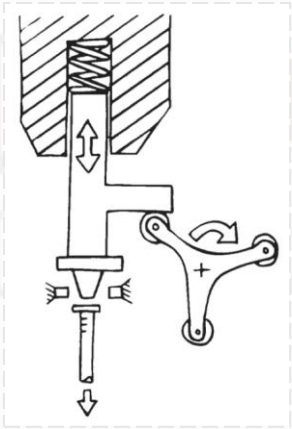
Concept Generation Example: Power Nailer

Problem Decomposition:
Function Diagram



Systematic Exploration:
Concept Combination Table

Convert Electrical Energy to Translational Energy	Accumulate Energy	Apply Translational Energy to Nail
rotary motor w/ transmission	spring	single impact
linear motor	moving mass	multiple impacts
solenoid		push nail
rail gun		



Concept Generation Exercise:
Personal Power Generation

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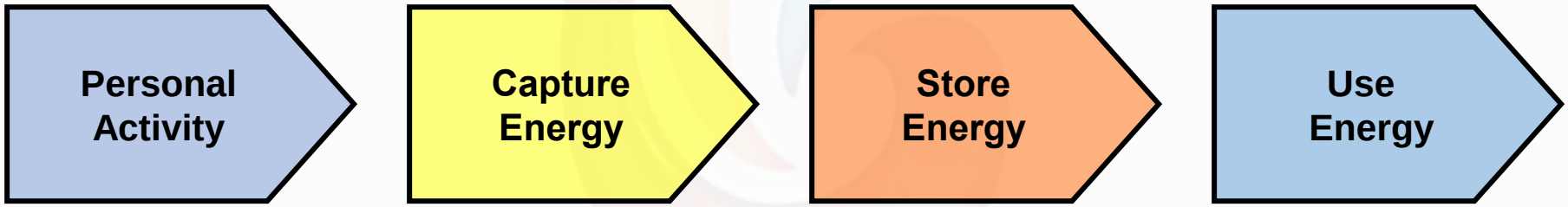
Personal Power Generation

Process Steps

1. Decomposition into sub-problems
2. Generate ideas for each sub-problem
3. Combine ideas into concepts

Decomposition:
Personal Power Generation



References

1. Karl T. Ulrich and Steven D. Eppinger (2009), Product Design and Development, 4th Edition, Tata McGraw-Hill Publishing Company Limited, ISBN: 978-0-070-14679-2
2. Stephen C. Armstrong (2005), Engineering and Product development Management– The Holostic Approach, Cambridge University Press, ISBN: 978-0-521-01774-9.
3. IbrahimZeid (2006), Mastering CAD/CAM, 2nd Edition, Tata McGraw-Hill, ISBN: 978-0-070-63434-3.
4. Anoop Desai, Anil Mital and Anand Subramanian (2007), Product Development: A Structured Approach to Consumer Product Development, Design, and Manufacture, 1st Edition, Butterworth-Heinemann, ISBN: 978-0-750-68309-8.

Thank you