

# Design 2 – Concept Generation

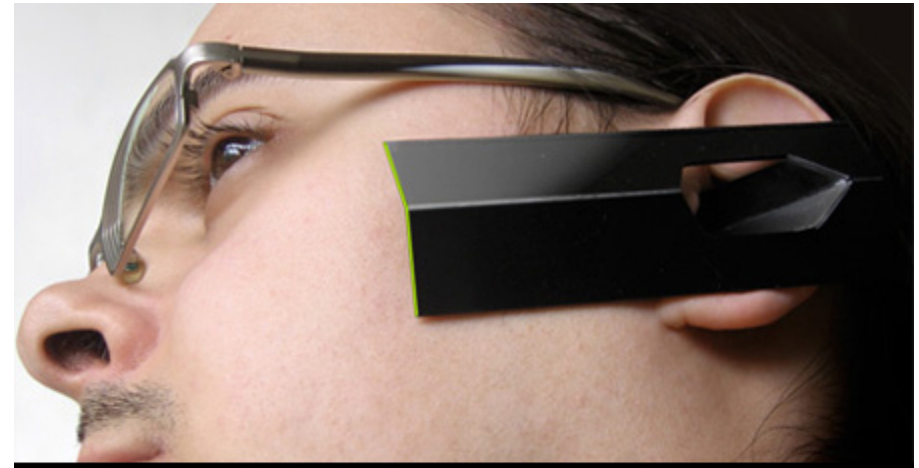
Dr. C. Alex Simpkins

ME490A

Fall 2014

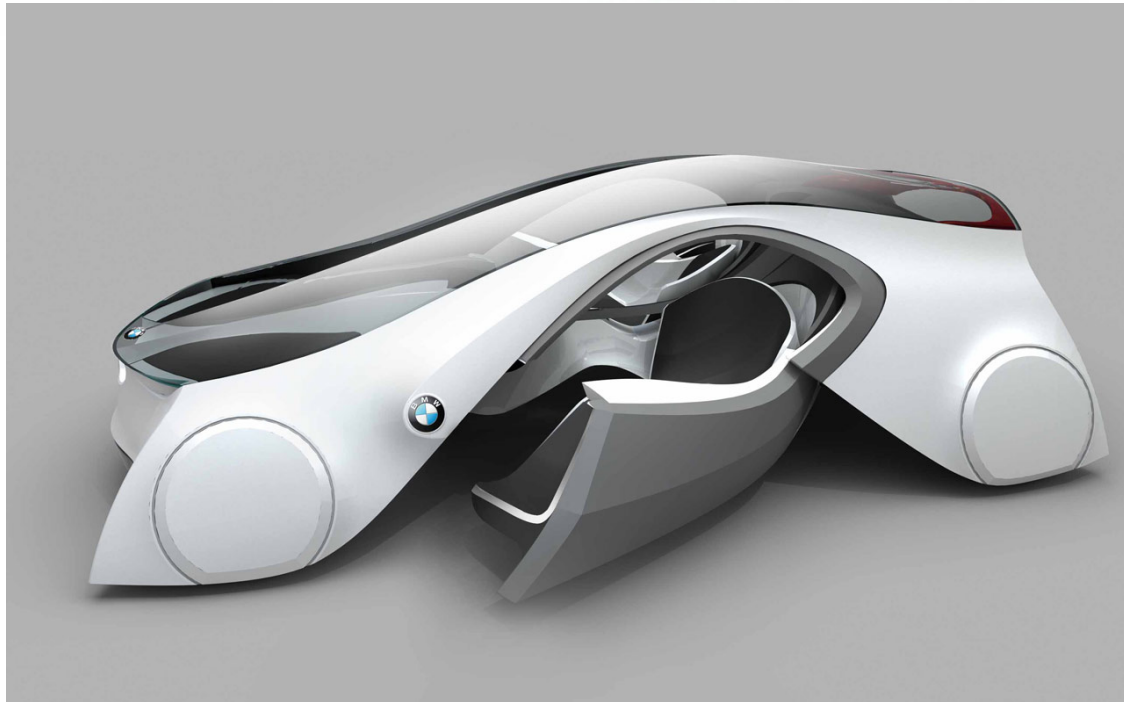
# Cell phone concept designs





# Automobile concepts

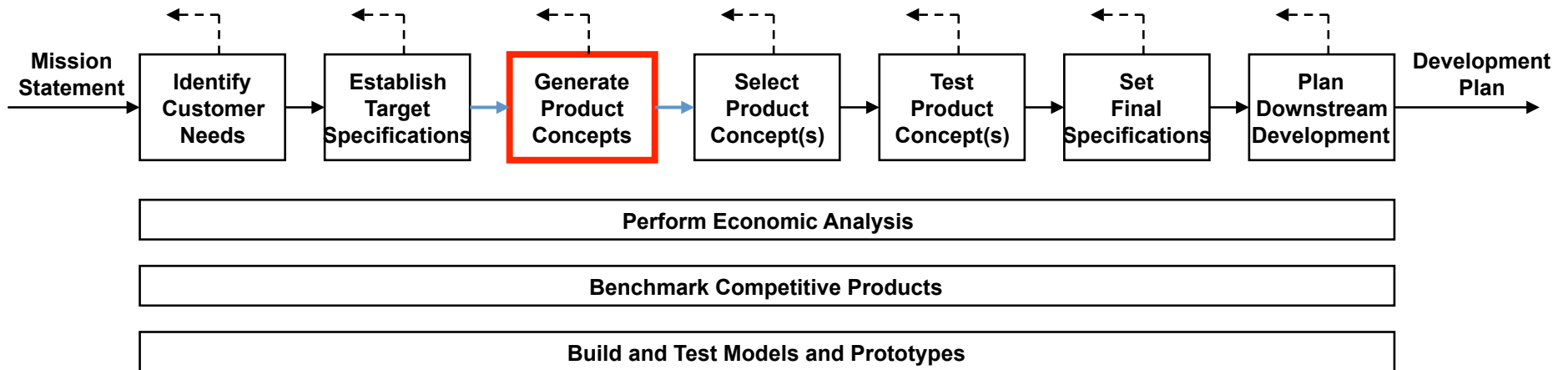






Concept Design &  
Modeling by  
Leonardo Lopez-Mobilia

# Concept Development Process



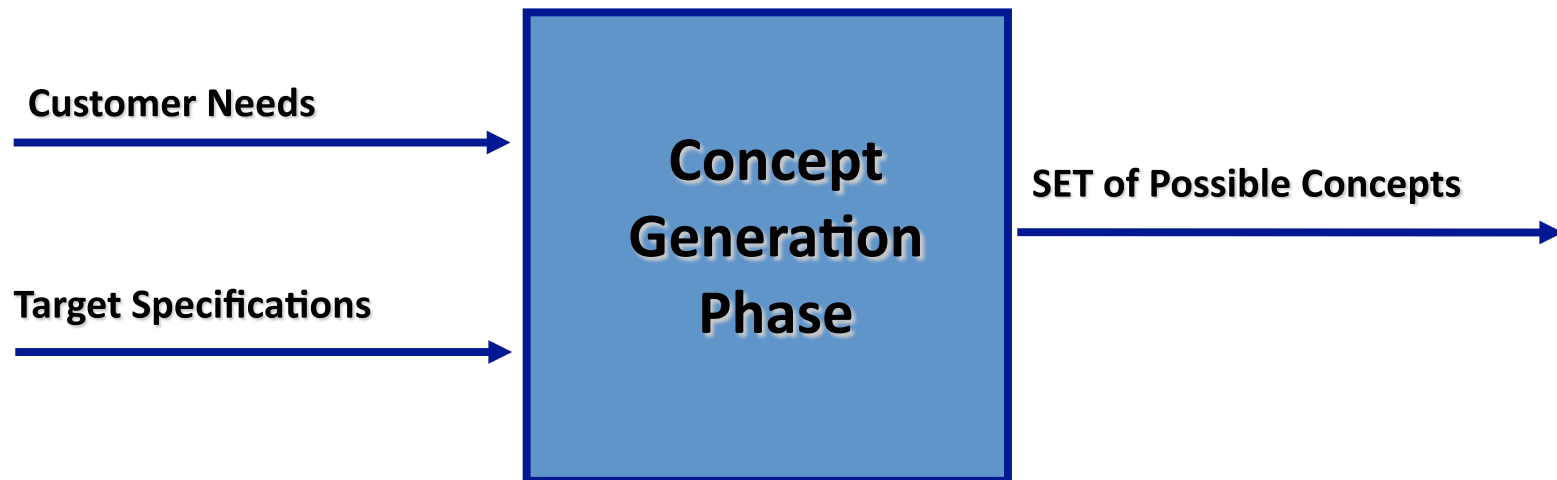
# Finding answers to the problems

- How many good designs are there?
- Which one is the best?
  - Generate potential designs
  - Organize them in ways that make their exploration easy
  - Evaluate them to see which are worth pursuing and which are not

# Concept Generation

*"Fail Often, Fail Fast, Fail early, Fail Cheap"*

*Goal: By the end of this phase, your team should feel confident that the full spectrum of options has been explored.*



# There is no box: Beyond the confines

- Not a lack of specific field, rather expansion to incorporate other sources of relevant work
- Example of Javier Movellan/MPLAB and computer vision (CV)
  - Applied machine learning to certain CV problems, and superior to all algorithms within that field
  - Face detection software in Sony cameras – Javier's group's algorithm



# Reframing

- Learn to reframe a particular problem in novel ways which elucidate novel paths
- What are all the permutations of what you see below?

710

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710 071 017

701 170 107

**BUT WHAT ELSE?**

014

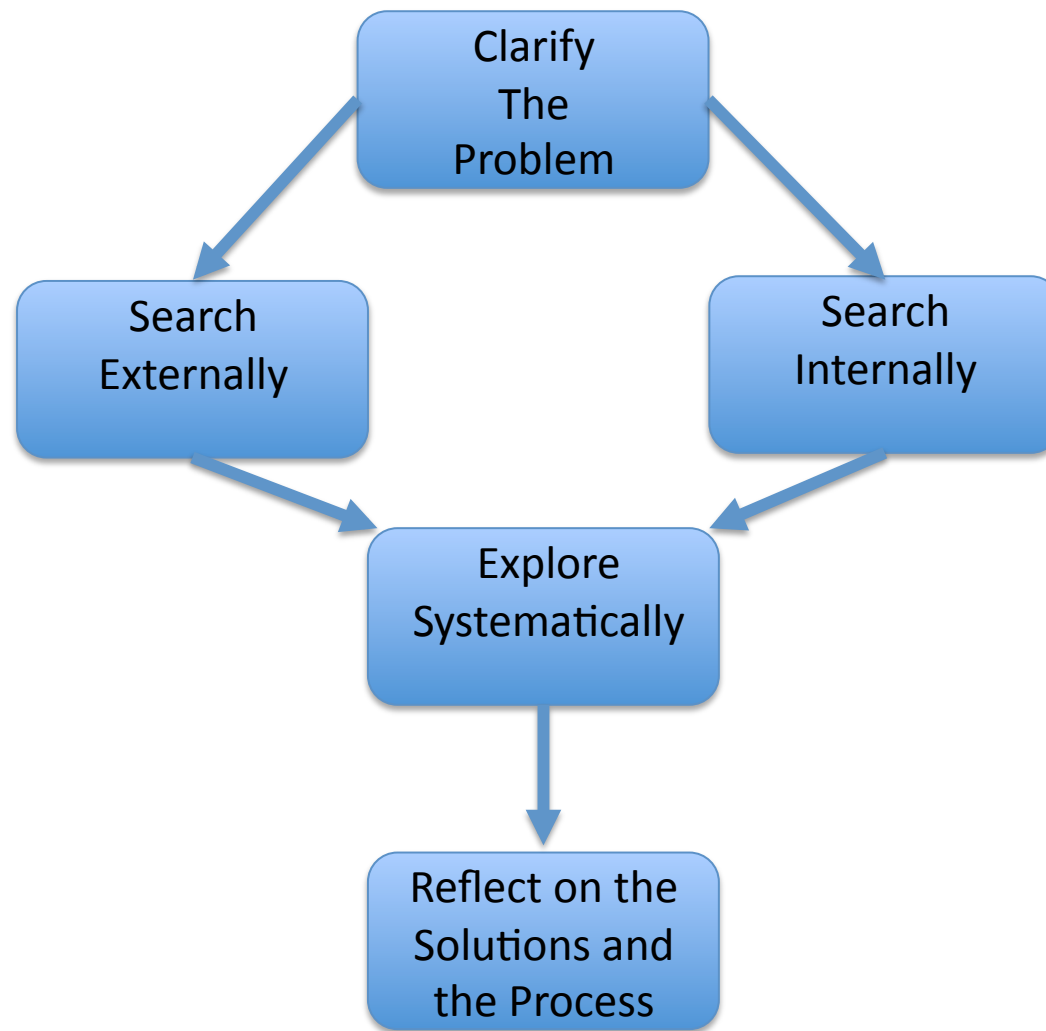
**BUT WHAT ELSE?**

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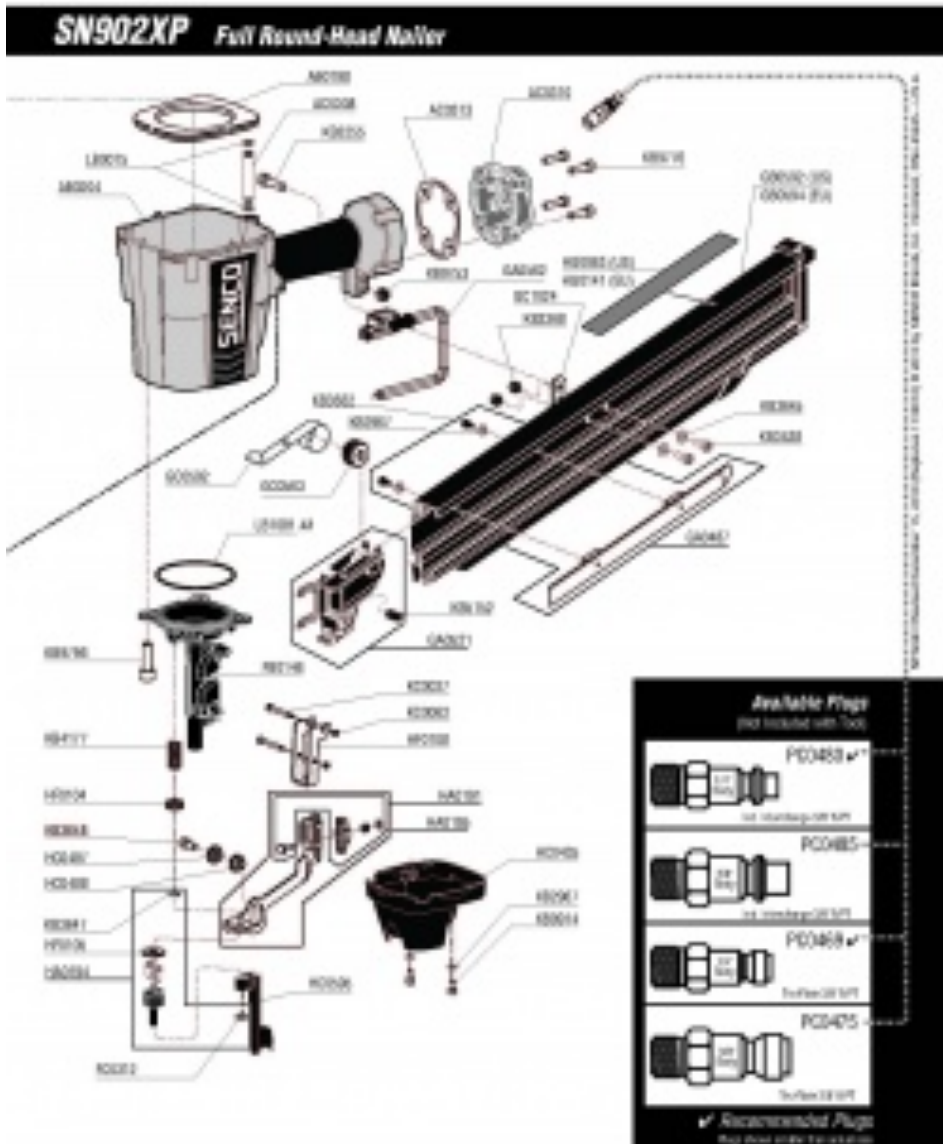
# Design space

- Construct a **design space** that envelopes or incorporates all of the potential solutions to a design problem
  - e.g.,: large design spaces: passenger aircraft, major office buildings
  - small or bounded design space: windows in aircraft or buildings
- Design interactions between **subsystems** and components
  - Decompose the overall functionality of a design into its constituent sub functions
  - Identify the means for achieving each of those functions
  - Enable the composition (or synthesis) of possible design solutions

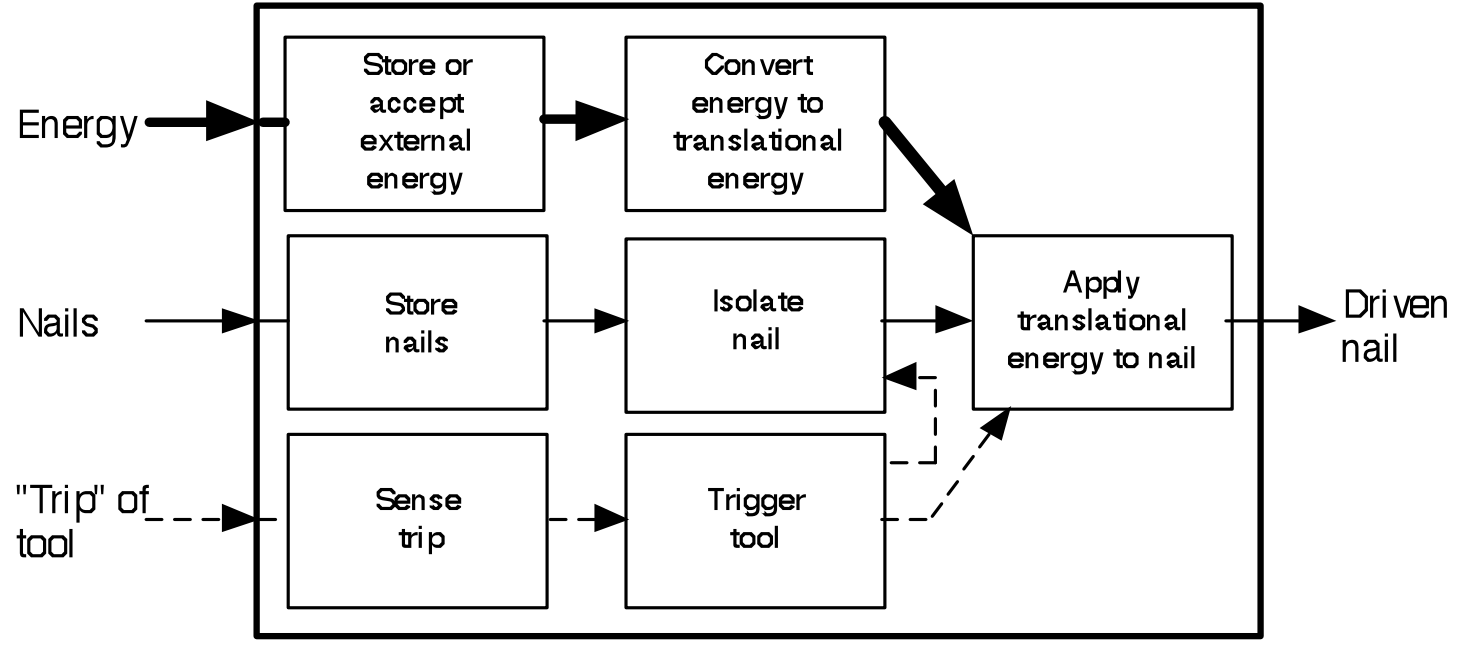
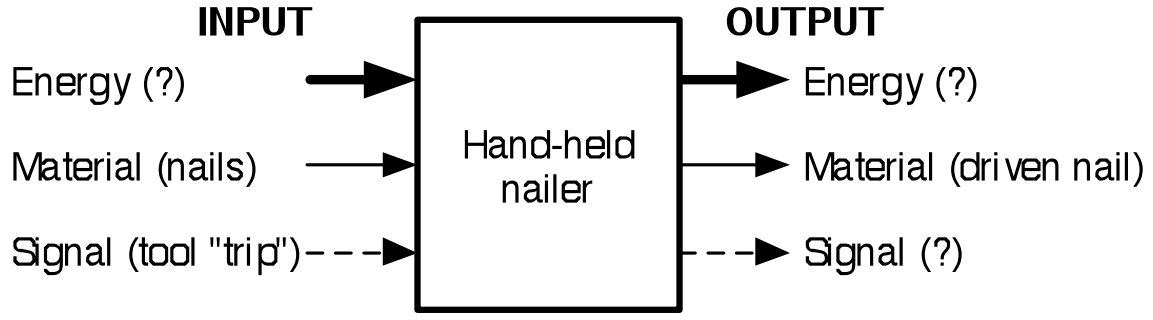
# Concept Generation Process



# Hand Held Nailer



# Function Diagram: Hand Held Nailer



# Generating design ideas

- Take advantage of design information that is already available
  - “We rarely gain any advantage by reinventing the wheel”
  - Web-surfing is a very useful, but, not an only way
- Patents: Expanding a design space without reinventing the wheel
  - USPTO (US Patent and Trademark Office)
  - Design patent: form or appearance
  - Utility patents – functions (i.e., stronger)
  - CASSIS (Classification and Search Support Information System)

# Patents/Literature

- US Patent and Trademark Office Web Site
  - <http://www.uspto.gov/>
  - <http://www.uspto.gov/web/offices/com/iip/index.htm>
- European Patent Office
  - <http://www.european-patent-office.org/online/>
- Academic Journals
  - Database tools such as web of science, engineering index, compendex, science citations index, etc.
- Conference Proceedings
- Internet Resources

# Morphological charts

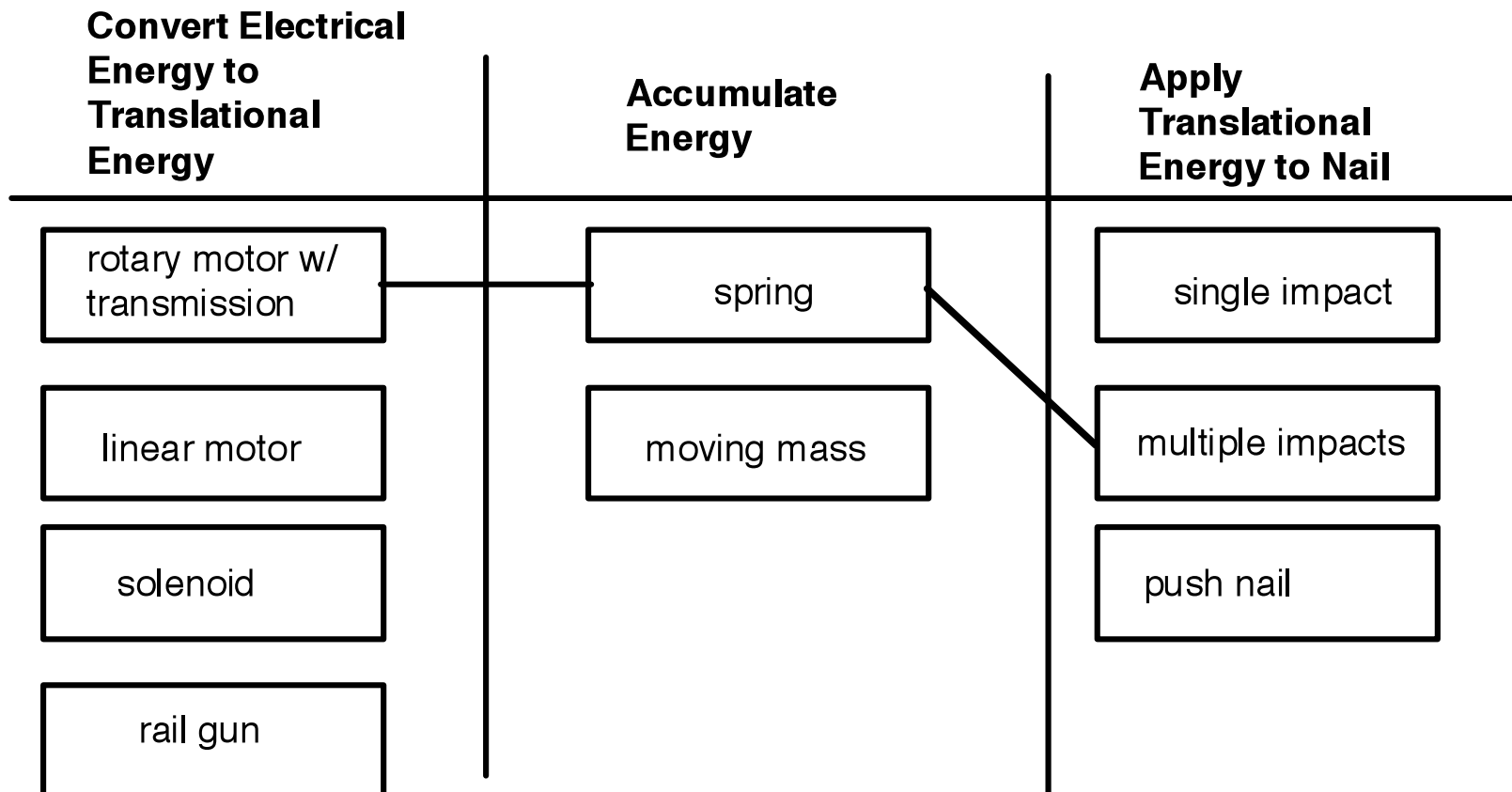
MEANS FEATURE/FUNCTION	1	2	3	4	5	6
Contain beverage	can	bottle	bag	box	••••	••••
Material for drink container	aluminum	plastic	glass	waxed cardboard	lined cardboard	mylar films
Mechanism to provide access to juice	pull tab	inserted straw	twist top	tear corner	unfold container	••••
Display of product information	shape of container	labels	color of material	••••	••••	••••
Sequence manufacture of juice container	concurrent	serial	••••	••••	••••	••••

**FIGURE 5.2** A morphological chart for the beverage container design problem. The functions that the device must serve are listed on the vertical axis, while for each of them two or more means are identified. Subject only to interface constraints that may prevent a particular combination, a conceptual design or scheme can be constructed by linking one means, any means, for each of the five identified functions, thus assembling a design in the classic “Chinese menu” style.

# Tips for Idea Generation

- Focus on generating a large QUANTITY of ideas
- Do not criticize individuals, ideas, or suggestions
- Do not pass judgment on the statements made
- Do not evaluate the merits of an idea – welcome ideas that may first appear infeasible
- Set goals – either fixed number of ideas in a session, or maximum ideas in a fixed length of time
- Analogies – What other devices solve related problem?
- Wish and wonder – Consider new possibilities

# Concept Combination Table - Hand Held Nailer



# For your project:

- List of sub-functions
- Identify and justify critical sub-functions
- Summarize results of external and internal searches of problem solutions, include several possible solutions
- Synthesize possible design solution combinations at the **sub-function** level

**Let's try it!**

Concept generation

# Flying skateboard

