

CS-E5250 Data-Driven Concept Design

Creative problem solving and idea Generation
Assignment 3

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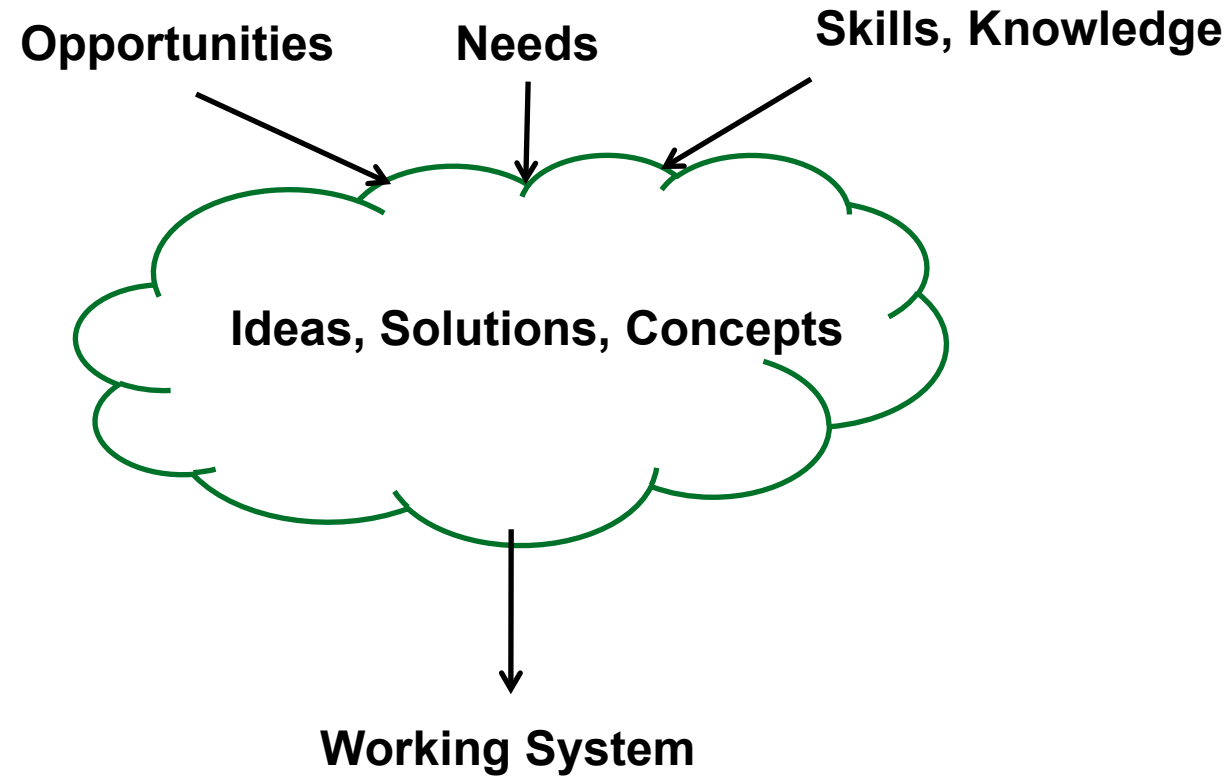
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- Learning outcomes
- Introduction to Creative problem solving
- Classifications of Idea generation
- Tools and Methods
- Examples
- Assignment details and DLs

Learning Outcomes

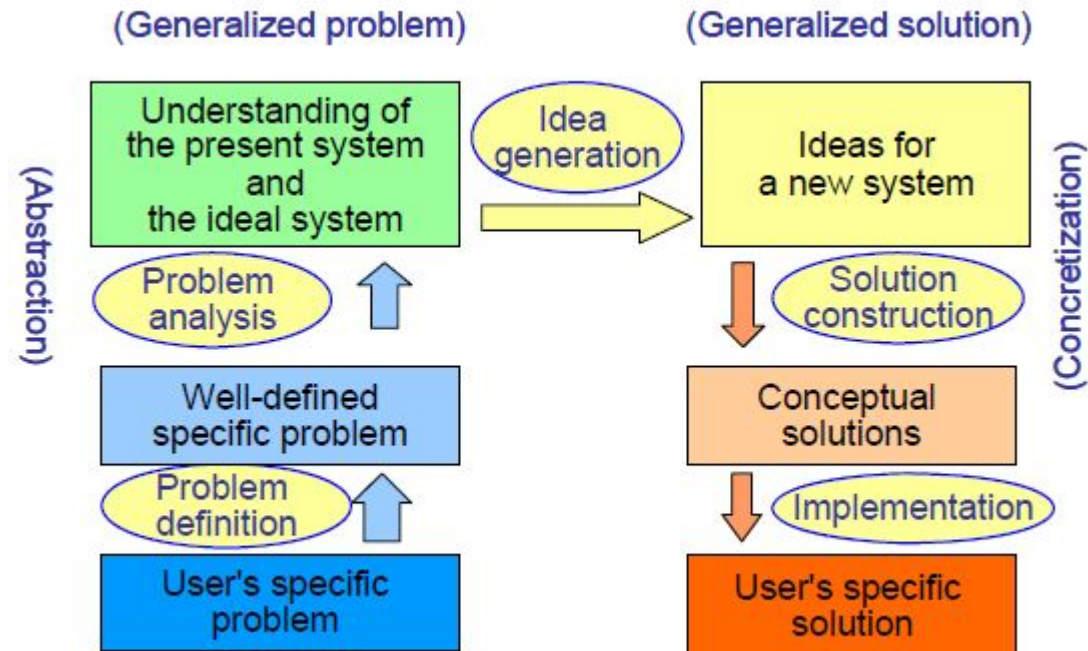
- You are, both individually and as part of a team, able to apply creative problem-solving methods in a rigorous manner to find innovative solutions based on demonstrable potential and limitations.

Creative Problem Solving



TRIZ

теория решения изобретательских задач,
teoriya resheniya izobretatelskikh zadatch,
"Theory of Inventive Problem Solving"



Source: Nakagawa, Toru, "Education and Training of Creative Problem Solving Thinking with TRIZ/USIT," ETRIA TFC2007, Frankfurt on Main, Germany, November 2007; TRIZ HP Japan, November 2007.

Different Styles for Innovation

How do you approach the innovation process?

Modifying and Visioning styles are more **focused**, well-planned, and results-oriented

VISIONING

People who have *Visioning* profiles like to imagine an ideal future and let long-term goals be their guide – they *envision* and *idealize*

What stimulates your innovative thinking?

Visioning and Exploring styles primarily use **intuition**, insights, and images

MODIFYING

People who have *Modifying* profiles like to refine and improve what has already been done – they *refine* and *optimize*



EXPLORING

People who have *Exploring* profiles like to question assumptions and discover novel possibilities – they *challenge* and *discover*

What stimulates your innovative thinking?

Experimenting and Modifying styles primarily use **facts**, details, and analysis

EXPERIMENTING

People who have *Experimenting* profiles like to test out various combinations of new ideas and learn from the results – they *combine* and *test*

How do you approach the Innovation process?

Exploring and Experimenting styles are more **broad**, perceptive, and learning-oriented

Source: www.innovationstyles.com

Idea Generation is...

- Trying to remove self-critique during the idea generation
- Almost always cheap. Unlike implementation.
- May produce solutions unavailable for deductive thinking and/or analytical problem solving.
- In idea generation More is More
 - Usual group sizes 3-8 persons, results in hundreds of ideas
- Practically limitless selection of methods
 - Smith* lists 172 idea generation techniques, classified by active ingredients

* Smith, G. J. (1998). Idea-generation technique: A formulary of active ingredients. *Journal of Creative Behavior*, 32, 107-134.
https://primo.aalto.fi/permalink/358AALTO_INST/1h25avu/cdi_crossref_primary_10_1002_j_2162_6057_1998_tb00810_x

Idea Generation Method Classifications

- Individual vs. Group
- Related stimuli vs. Unrelated stimuli
- Association free vs. Forced
- Expression
- The creativity continuum
 - Paradigm Preserving
 - Paradigm Stretching
 - Paradigm Breaking

Source: McFadzean, E.S. (1999), "Creativity in MS/OR: choosing the appropriate technique", Interfaces, Vol. 29 No. 5, pp. 110-22.

Ideation methods

- Brainstorming (also in reverse)
- Brainwriting (method 6-3-5)
- Bodystorming
- Delphi Method
- Rubber Ducking
- Remembrance
- Wishing
- SCAMPER
- 5W1H
- Force field
- Six Thinking Hats

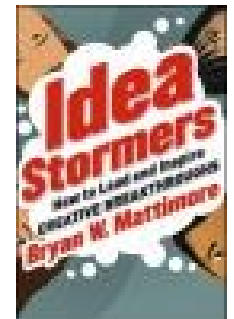
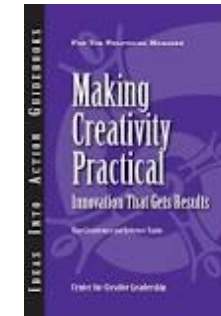
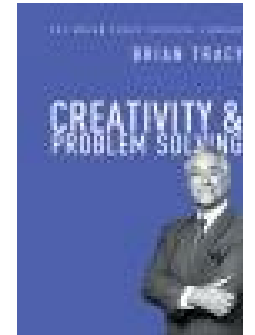
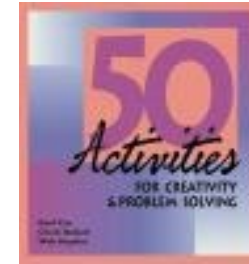
Other web sources

https://www.mindtools.com/pages/main/newMN_CT.htm

Source: <http://creatingminds.org>

Other sources for CPS or ideation methods

- Cox, Geof., Chuck. Dufault, and Walt. Hopkins. **50 Activities for Creativity and Problem Solving**. 1st edition. Amherst, Mass: HRD Press, 1993. Print.
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- Mattimore, Bryan W. **Idea Stormers How to Lead and Inspire Creative Breakthroughs** . 1st ed. San Francisco: Jossey-Bass, 2012. Print.
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Brainstorming

- Alex Osborne, orig. 1939 popular in 50's
 1. Judgment of ideas is not allowed
 - this comes later
 2. Outlandish ideas are encouraged
 - these can be scaled back later
 3. Large quantity of ideas is preferred
 - quantity leads to quality
 4. Members should build on one another's ideas
 - members should suggest idea improvements

OSBORNE, A. F. Applied imagination. (Rev. ed.) New York: Scribner, 1957.

Six principles for brainstorming

1. Brainstorming should have clear and explicit instruction emphasizing number of ideas over quality of ideas.
2. Brainstorming should have an in advance set target number of ideas to generate. This number should be high.
3. Initial ideas should be created by individuals not groups.
4. Ideas should be analyzed and refined in groups.
5. Final rating of the ideas should be left to the individuals to increase commitment, and
6. Time allocated to the brainstorming activity should be remarkably short.

Rossiter, J.R., Lilien G.L. (1994). New “Brainstorming” Principles. Australian Journal of Management, Vol. 19, No. 1.

Brainwriting

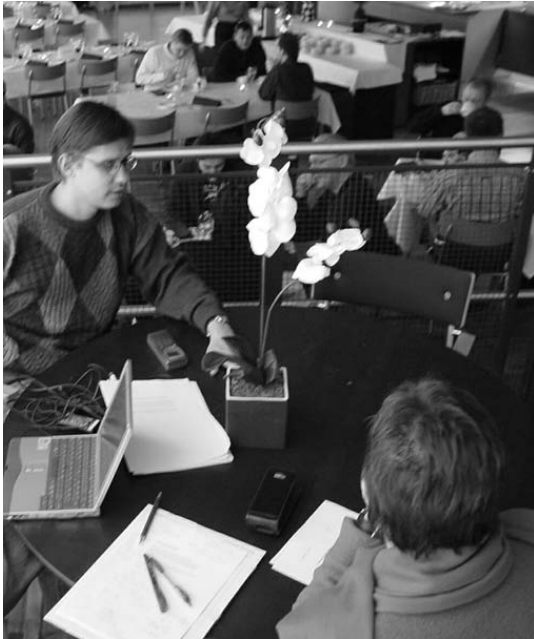
- Force people to empty their minds to paper
- Method 6-3-5 *
 - 6 people write 3 ideas in 5 minutes
 - Rotate lists, read the earlier entries
 - Add 3 new entries and rotate... Until full circle
- Produces 108 ideas in 30 minutes, normally half of these are redundant, but some are feasible.

Rohrbach, B: Kreativ nach Regeln – Methode 635, eine neue Technik zum Lösen von Problemen. Absatzwirtschaft, Vol 12, 1969. p73-75 and Volume 19, 1 October 1969.

Chaehan So, Soojung Jun, and Ken Nah. Configuring Time for Creativity: How to Optimize the Ideation Process in Design Thinking Workshops. *The International Journal of Design Management and Professional Practice* 10, 4: 27–33.

Bodystorming

- Use the tools of drama to get into the part of a user
- Can use either real or simulated context



Oulasvirta, A., Kurvinen, E., and Kankainen, T. 2003. Understanding contexts by being there: case studies in bodystorming. *Personal Ubiquitous Comput.* 7, 2 (Jul. 2003), 125-134.

Delphi Method

- Define problem
- Find a group of experts to solve the problem (~20)
- Send them the problem and ask short concise answers
- Collect answers and compose a single anonymous list
- Send to the group for evaluation and scoring
 - If major changes iterate the collect&compose phase
- Preferably reach consensus at the end

Rubber-Ducking

- Find someone to listen to you
- If nobody is available, talk to the duck
- Ask them to **listen**, to **nod**,
but *not to make any comments or
try to offer solutions.*
- As you talk to them, you may find that an idea or solution comes to mind...



Remembrance

- Old Buddhist technique to make things happen.
- Think of a problem around it. Place the incident in the past and tell the others how you solved it.
- At the start the gap between problem and solution can be wide, but step by step remember more of the way you made your heroic rescue.
- Also used as an interrogation method by the police
 - Reid techniques

Wishing or Wouldn't it be nice if...

- Think of the situation in a wishful, fantastic way, beyond sensible, beyond practical or feasible.
- Frame ideas by starting with “I wish...” or “Wouldn't it be nice if...”
- Wishing is contagious

SCAMPER

- Restructuration of Osborne's original brainstorming rules by Bob Eberle
 1. Substitute
 2. Combine
 3. Adapt
 4. Modify (also Magnify and Minify)
 5. Put to other uses
 6. Eliminate
 7. Rearrange

5W1H

- I have six honest serving men
They taught me all I knew
I call them **What** and **Where** and **When**
And **How** and **Why** and **Who**

Rudyard Kipling

- What is the problem? *My suitcase is too heavy*
- Where is it happening? *At the airport*
- When is it happening? *In the evening, coming back from France*
- Why is it happening? *Because I have bought some wine*
- How can you overcome this problem? *Get the wine shipped*
- Who do you need to get involved? *Winery will do it for me*
- When will you know you have solved the problem? *When it arrives at home*

Six Thinking Hats

- Based on Lateral Thinking by Edward De Bono

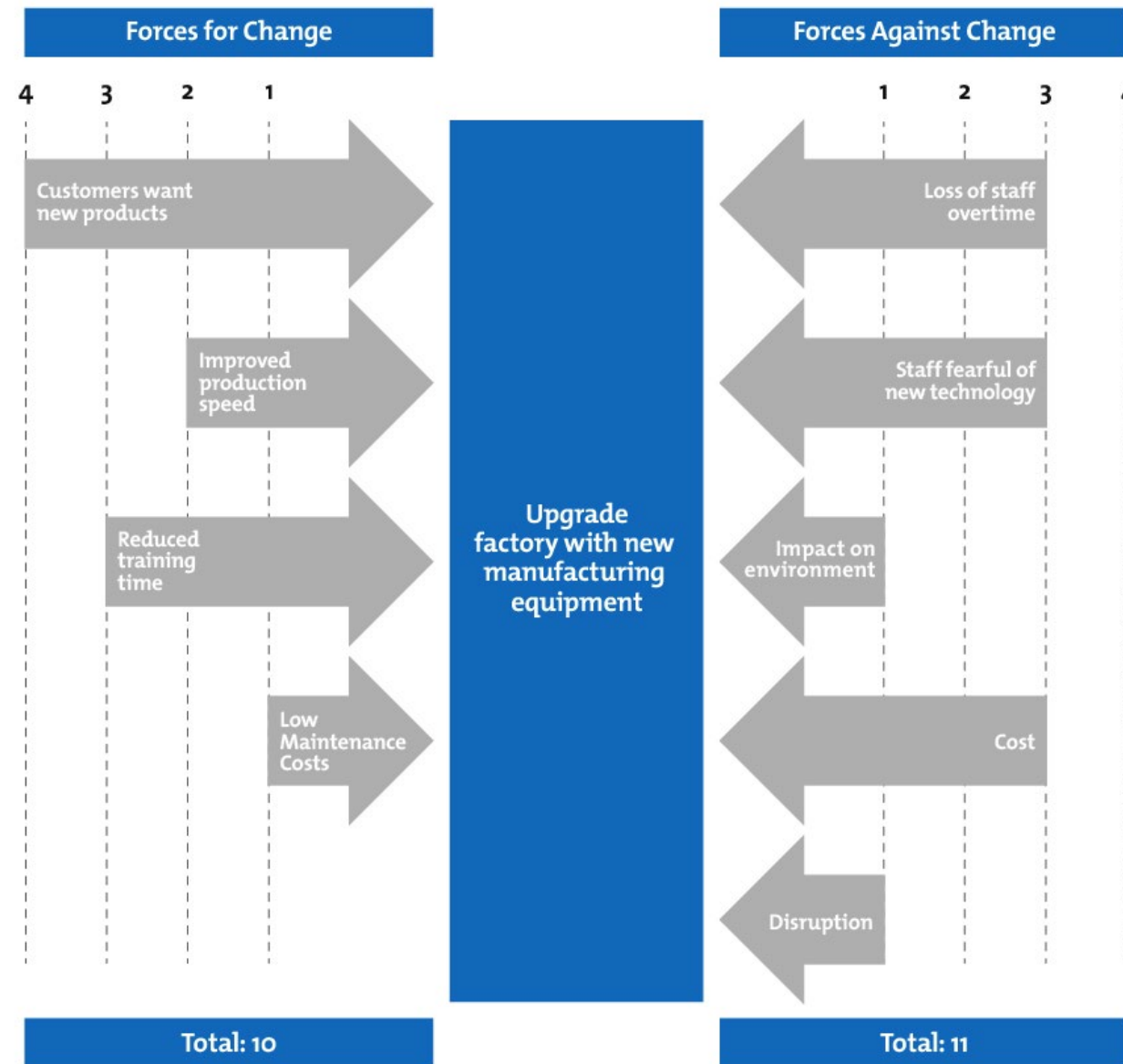
Color	Meaning	Description
White	Information	Asking for information from others.
Black	Judgement, Pessimism	Playing devil's advocate. Explaining why something won't work.
Green	Creativity	Offering possibilities, ideas.
Red	Intuition, Emotion	Explaining hunches, feelings, gut senses.
Yellow	Optimism	Being positive, enthusiastic, supportive.
Blue	Thinking	Using rationalism, logic, intellect.

Selecting or Evaluating the Ideas

- Usually dependent of the focus and subject
- Main variants
 - Rate the goodness of the ideas
 - Plus/minus/star ratings etc.
 - Rate the relative goodness of the ideas
 - Pair Rating
 - Rate the ideas' attributes
 - Pros&Cons, Benefits, Strengths, Weaknesses



Force Field Analysis



Examples

Bodystorming in kitchen



Examples

Brainwriting idealist

	U=ei hyvä, 1= hyvä mutta ei saa päälle, 2= ei välttämätön mutta saa päälle, 3=hyvä ja saa päälle		
Akku / Tiedon purku	54	Antti	3 Laitteeseen niin pieni virrankulutus, ettei tarvi ladata edes joka viikko
Akku / Tiedon purku	96	Antti	3 Laite saa akkuihinsa voiman generaattorista, joka käyttää bussin liike-energiaa. vrt. rann
Akku / Tiedon purku	103	Mikael	3 Akkujen lataaminen tarkastajien liikkeestä esim. kokoonpainuvat generoivat kengänpohj
Akku / Tiedon purku	119	Maija	3 Akun voi irrottaa ja vaihtaa tai ladata takin selän aurinkokennolaturin avulla
Imago ylös	165	Maija	3 Haukkujille tulostettu esite siitä, millaista koulutusta tarkastaja on saanut
Kieli	134	Mikael	3 Lauseita kääntävä sanakirja tarkastajalaitteeseen
Kieli	135	Mikael	3 Yleisimmät fraasit ääntämisohjeineen sadalla kielellä
Laitteen koko	40	Sirpa	3 Pienempi, ergonomisempi, kännykän kokoinen laite
Laitteen koko	59	Maija	3 Ranteeseen kiinnitettävä tarkastajalaite
Laitteen koko	105	Juha	3 Tarkastajalaite pienemmäksi
Laitteen koko	175	Mikko	3 ranteeseen sidottava tarkastajalaite
Näyttö	70	Mikael	3 Datalasit, jotka näyttävät matkustajan tiedot tarkastettaessa
Näyttö	117	Maija	3 Silmälappunäyttö
Organisaatio/Koulutus	56	Antti	3 Laitteeseen koulutustietokanta, josta voi tarkastaa toimenpideohjeita
Paikannus	43	Maija	3 Tarkastajan paikannus, valvonta toimistosta
Paikannus	109	Mikko	3 Paikannuslaite
Paikannus	112	Mikael	3 Laite tietää GPS-paikannuksen avulla millä pysäkillä ollaan
Paikannus	124	Antti	3 Laitteessa on GPS-paikannus yhdistettynä bussiaikatauluihin
Paperit	11	Mikael	3 Tarkastajalaite printtaa tarvittavat paperit (Mikael)
Paperit	42	Maija	3 Kuittien tulostus tarkastajalaitteesta
Paperit	62	Juha	3 Matkakorttiin henkkarit sähköisesti
Paperit	63	Juha	3 Tietojen kirjoitus laitteeseen, ettei tarvitse tehdä muistiota maksusta
Paperit	94	Antti	3 Taskukokoinen printeri, tai jos se on painava niin vain 1/tarkastajapari
Paperit	98	Maija	3 Selkäreppuprintteri (kevyt)
Paperit	176	Mikko	3 kuittitulostin mukaan
Tarkastustilanne	1	Sirpa	3 Tarkastustilanteessa laitteen näyttöön tulisi kaikki tarvittavat tiedot henkilöstä ja tarkas osoite, kortin tiedot (Sirpa).
Tarkastustilanne	2	Maija	3 Tärkeät tiedot kaikki kerralla, muut vain 1-2 napin painalluksen takana. (Maija)
Tarkastustilanne	9	Antti	3 Liputta luvallisesti matkustavien määrä helposti (Antti). Esim 12 lasta

Tools for Online Ideation

- Google docs
- Various shared whiteboard or post-it note services
 - Miro (miro.com)
 - flinga.fi
 - note.ly
 - Micro\$oft Teams