Investigating Ideation Flexibility through Incremental to Radical Heuristics

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Overview

Previous work in ideation flexibility

KAI theory

I2Rh ideation tool

Study methods

Results & discussion

Conclusions
Ideation is the **creative process** of generating, developing, and communicating new ideas, where an idea is understood as a **basic element** of thought that can be either visual, concrete, or abstract.

DIVERGE

CREATE CHOICES

MAKE CHOICES

CONVERGE
Idea generation is *vital* to the design process
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Challenges with idea generation

- Difficulty generating multiple ideas
- Fixation
  - Existing products
  - Previous experiences
  - First idea syndrome

Crilly 2015, Vasconcelos and Crilly 2016
Ideation Flexibility

Many constraints

Problem

Problem

Problem

Open-ended

Silk, Daly et al. 2014, Silk, Daly et al. 2014, Yilmaz, Daly et al. 2014
Cognitive style and KAI

Cognitive style

- How we are creative
- Reflection of self

Kirton’s adaption-innovation Theory

Kirton 1976, Kirton 2011
Kirton’s adaption-innovation theory

Adapters
- Improve current system
- Precise, reliable, and methodical.
- Rarely challenge rules
- Produce fewer ideas that are more manageable, relevant, sound, and safe for immediate use.

Innovators
- Doing things differently.
- Work outside current paradigm.
- Question assumptions.
- Rules and structure are limiting or hindering progress.
- Tolerate high failure rate.
Design Heuristics 77 Cards

Design Heuristics push you to think beyond your initial ideas
Design Heuristics 77 Cards

**Title introducing heuristic**

**INCORPORATE ENVIRONMENT**

Use the surrounding environment (living or artificial) to perform a part of the product's function or serve as a product component. This can reduce material, create uniformity with the environment, and increase environmental awareness.


**Explanation of heuristic**

**INCORPORATE ENVIRONMENT**

**LAWN CHAIR+COUCH**

Earth Furniture

By building a structure, filling it with dirt, and planting grass, this seating becomes part of its environment.

**Product examples**

**TREE HUGGER**

Zack Jacobsen-Weaver

This mechanism tightens its grip when weight is applied without damaging the tree, allowing the user to hang canopies, hammocks, or other objects safely.
Incremental to Radical Heuristics (I2Rh)

KAI theory
Development of Incremental to Radical heuristics (I2Rh)

**Problem statement**

**SAME FRONT**

**INCORPORATE ENVIRONMENT**

**Incremental example**

**DoubleNest Hammock**
*Eagles Nest Outfitters*
This is a hammock that can be strung up between two trees. The flexibility to reconfigure to trees make this an incremental solution to lounging.

**Radical example**

**KAISR LOUNGE CHAIR**
*KAISR*
This seating device is essentially a large bag which can be held up to the wind, rolled, and sealed to create an inflatable lounge chair.

Use the surrounding environment (living or artificial) to perform a part of the product’s function or serve as a product component. This can reduce material, create uniformity with the environment, and increase environmental awareness.

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**Problem Statement:**
Design a way to provide comfortable seating.

**DoubleNest Hammock**
*Eagles Nest Outfitters*
This is a hammock that can be strung up between two trees. The flexibility to reconfigure to trees make this an incremental solution to lounging.

**KAISR LOUNGE CHAIR**
*KAISR*
This seating device is essentially a large bag which can be held up to the wind, rolled, and sealed to create an inflatable lounge chair.
“We questioned the effect of I2Rh on student ideation flexibility and possible variable use of heuristics by students with diverse cognitive styles.”

1. How do design students perceive and use the I2Rh?

2. How do high adaptors versus high innovators use the I2Rh?

3. How do the adaptive versus innovative product examples impact solution outcomes?
Participants

- Undergraduate Industrial Design and Architecture students.
- Iowa State University
  *During INDD Sketch Club*
- 26 participants
  - 3 freshman, 14 sophomores, 2 juniors and 7 seniors.
  - 17 male (65%), 9 female (35%)
- Ages between 18 and 26.
Materials

KAI inventory

Study materials packet
- Problem brief
- Idea sheets (5 each session)
- Reflection surveys (2)
- Demographic survey

Creative
Diverse
Elaborate

Easy or difficult it was to come up with design solutions.

Problem briefs

Snow Transporter
A way for individuals with little skill or experience in skiing or snowboarding to transport themselves on snow.

Can Opener
A way for individuals with limited or no use of one upper extremity to open a lidded food container with one hand.

Jin and Chusilp 2005
Data Collection

Welcome & Study instructions (10 min.)

KAI inventory (10 min.)

Session 1 Neutral (20 min.)

Reflection survey (10 min.)

Session 2 Ideation with I2Rh cards (20 min.)

Reflection survey (10 min.)

Post study demographics survey (10 min.)
Data Analyses

Cognitive Style

KAI inventory

Concept generation

Reflection surveys

- Creative
- Diverse
- Elaborate
- Easy or difficult
Results & discussion

- 25 participants (one person didn’t complete the I2Rh ideation session)

- Less concepts in I2Rh session than Neutral session

- 22/25 participants used the I2Rh Cards
  21 used the incremental example
  17 used the radical example

- High Adapters = <78 KAI
  High Innovators = >112 KAI

- Generated 109 concepts in Neutral session and 88 in I2Rh session
Fatigue and fixation between sessions.

Observations

- “In between legs contraption”
- “A jar opener that goes under the counter, incorporating the surrounding environment, has prongs/clasps/grips to hold jar in.”

End of Neutral Session

Start of I2Rh Session

Cards used
- #39 Incorporate Environment
- #48 Nest
Observations

• Use of same I2Rh card by Adapter vs. Innovator

P5 (KAI 120): used incremental eg.

“Sled that moves through snow like an auger.”

P6 (KAI 69): used radical eg.

“These skis have tips that can bend the opposite direction to turn them into snow shoes.”

AeroTwist
Kateryna Sokolova
This Bluetooth speaker can be opened and thus easily attached to a bag or bicycle. This donut shape allows it to twist and loop onto other products.

MUSIC WRAP
Wistrion Corporation
This product has a flexible construction for various usages, such as wrapping around bicycle, docking for smartphone or tablet, or even wearing on neck.
Impact of I2Rh on student perceptions

Neutral Session
- Participants felt their ideas were more creative, elaborate, and came easy.

I2Rh Session
- Participants felt their ideas were more diverse.

Participants found that navigating the neutral ideation session was easier than the I2Rh session. As the students’ cognitive styles (KAI) increase and become more innovative, they perceived the ease in generating ideas as greater in the Neutral session.

Table X. Mean responses to reflection surveys (1 to 7 scale) [N=25]

<table>
<thead>
<tr>
<th></th>
<th>Creative</th>
<th>Diverse</th>
<th>Elaborate</th>
<th>Ease of Generating Ideas</th>
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<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
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<tr>
<td>Neutral</td>
<td>4.40</td>
<td>1.22</td>
<td>4.32</td>
<td>1.28</td>
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<tr>
<td>I2Rh</td>
<td>4.08</td>
<td>1.47</td>
<td>4.72</td>
<td>1.62</td>
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Table X. Bivariate correlations for KAI total and Reflection Responses [N=25]

<table>
<thead>
<tr>
<th></th>
<th>KAI total</th>
<th>Elaboration (neutral)</th>
<th>Creativity (I2Rh)</th>
<th>Diversity (I2Rh)</th>
<th>Elaboration (I2Rh)</th>
<th>Ease (I2Rh)</th>
<th>Correlation Strength</th>
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<td></td>
<td>r</td>
<td>p</td>
<td></td>
<td></td>
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<tr>
<td>KAI total</td>
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<td>0.034</td>
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<td>0.005</td>
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<td></td>
<td>Strong</td>
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<tr>
<td>Creativity (I2Rh)</td>
<td>0.535</td>
<td>0.006</td>
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<td>Strong</td>
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<td></td>
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<td>Moderate</td>
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<td>0.450</td>
<td>0.024</td>
<td></td>
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<td></td>
<td></td>
<td>Moderate</td>
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</table>
Six extreme cases (2 high adapters and 4 high innovators.)

Both adapters and innovators showed gravitation towards opposite side of A-I spectrum from KAI inventory score.
Extreme cases continued

**High Adaptors**
- Felt constrained by time and inability to read everything on the card.
- Gave cards more credit; they inspired more ideas.

**High Innovators**
- Time pressure
- Forced heuristics to fit problem

<table>
<thead>
<tr>
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<th>Neutral Ideation</th>
<th>Ideation with I2Rh</th>
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<tr>
<td></td>
<td>Creative</td>
<td>Diverse</td>
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<tr>
<td>High Innovators</td>
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<tr>
<td>High Adaptors</td>
<td>4.5</td>
<td>5</td>
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</table>
Feedback we did not receive was the awareness of the difference between incremental and radical examples on the back of the cards.

Differences in card use between adapters and innovators.

Moving forward with the cards
• Quantity of information.
• Could the ideas be understood without problem statement?

Give more time to understand cards or training session to familiarize participants beforehand.
THANK YOU!