# Engineering Creativity and Innovation


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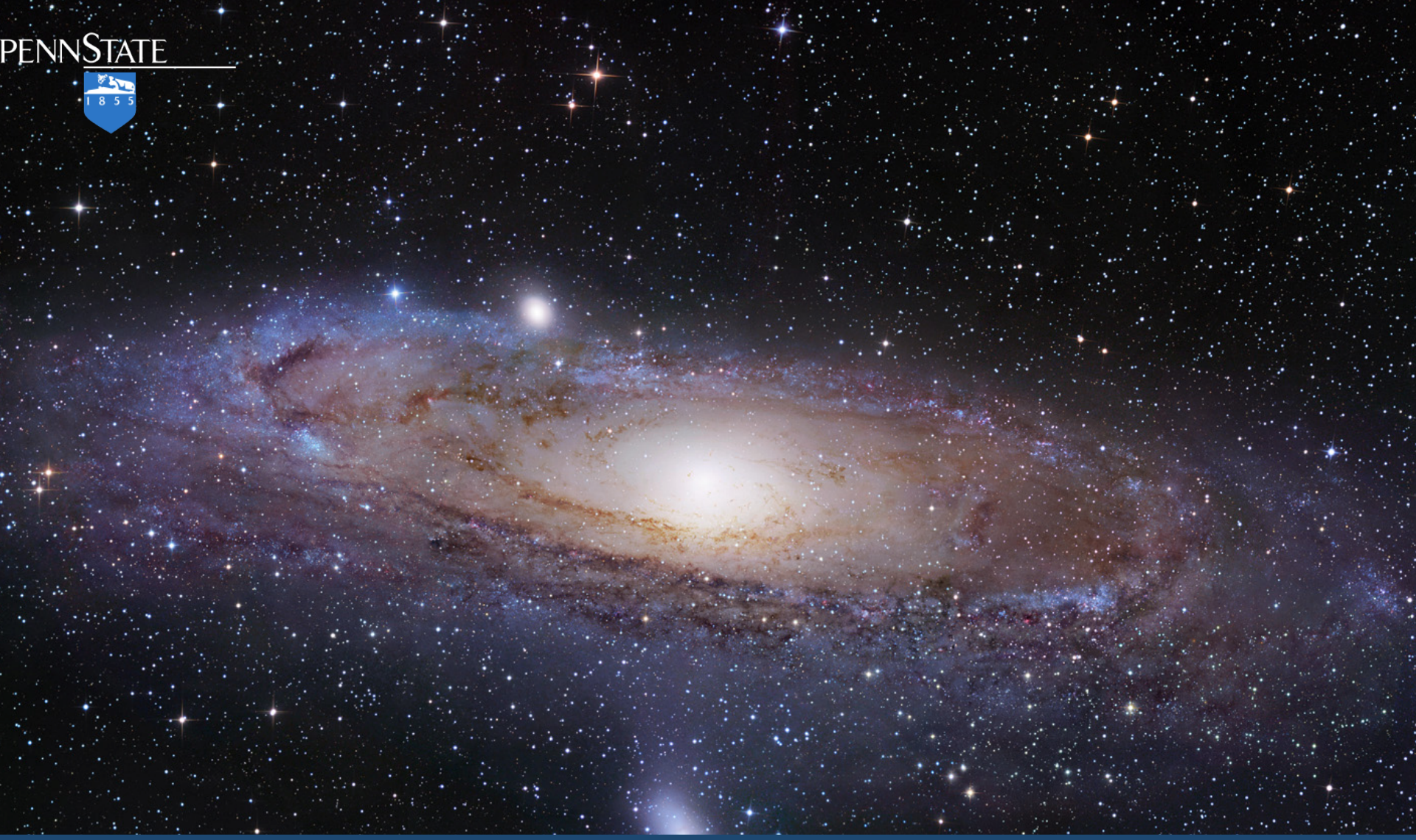


**The *ex-nihilo* problem:**

**"something comes out of nothing"**

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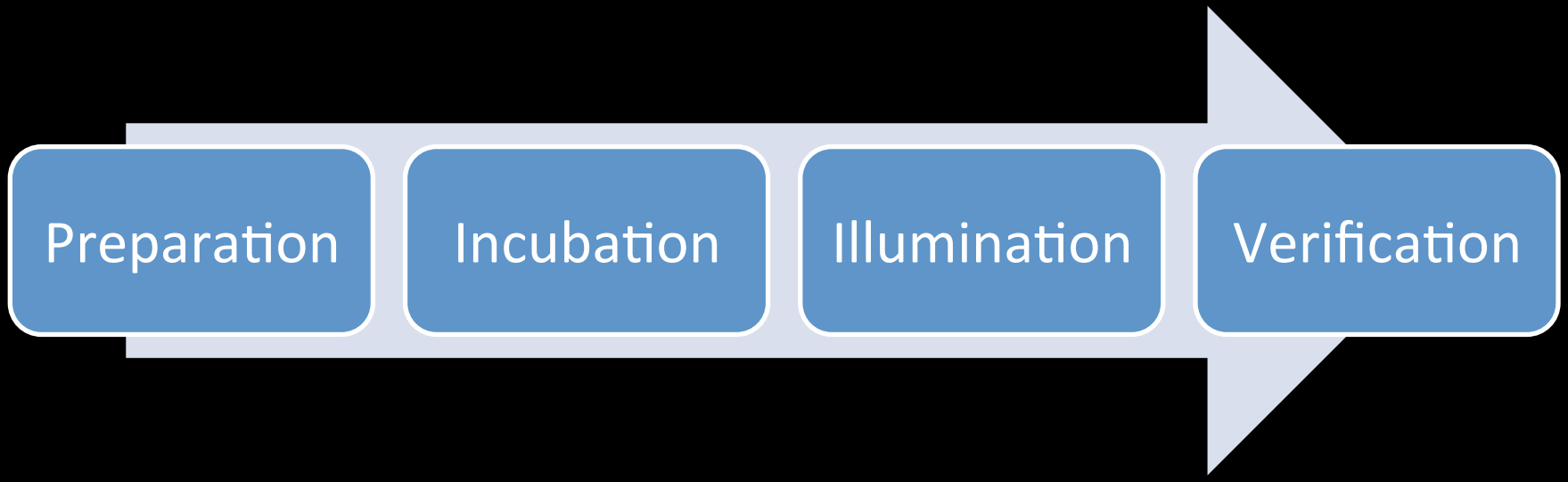
# The Creative Process




[Wallas 1926]

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What is the difference between creativity and innovation?

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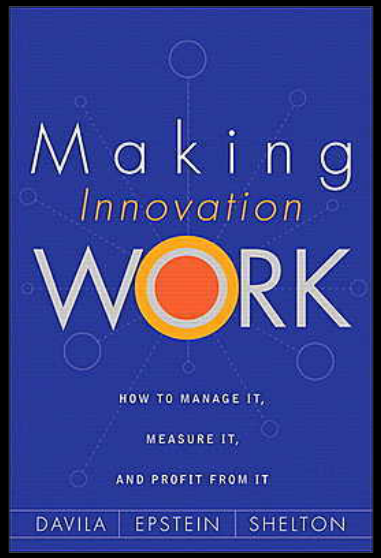
"…*creativity* implies coming up with ideas, it's the 'bringing ideas to life'… that makes *innovation* the distinct undertaking it is."




Davila, Epstein and Shelton (2006).

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Is creativity important in engineering? Why or why not?

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"Creativity… is an indispensable quality for engineering, and given the growing scope of the challenges ahead and the complexity and diversity of the technologies of the 21st century, creativity will grow in importance."

[The National Academy of Engineering 2004]

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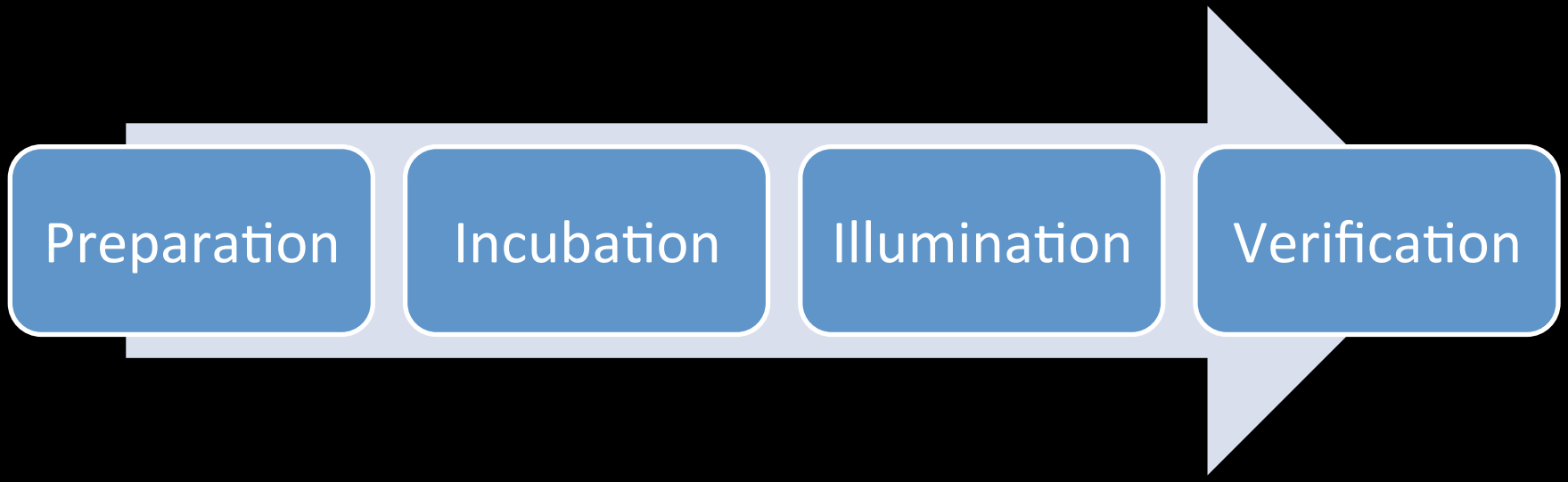
# The Creative Process




[Wallas 1926]

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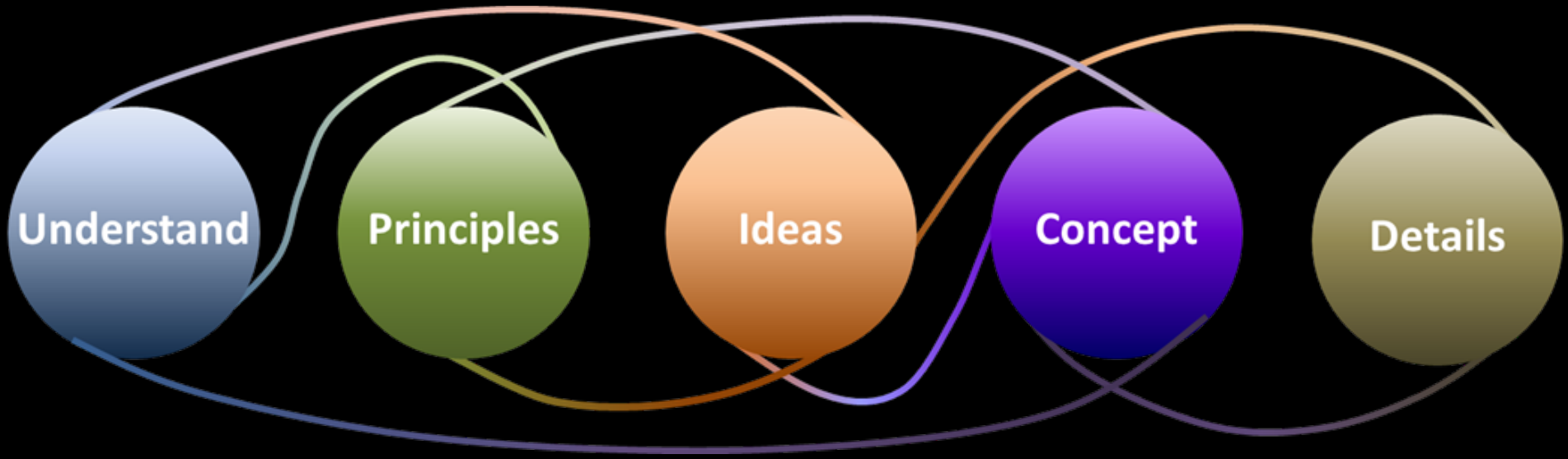
# Innovative Engineering Design Process




[Lau 2013]

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# 5 steps to help you be more creative

1. Spend time *understanding* the problem
2. Look at the problem from different perspectives
3. Spend time learning about the world around you
4. Work in an inter- or multi- disciplinary team
5. Work in a creative environment

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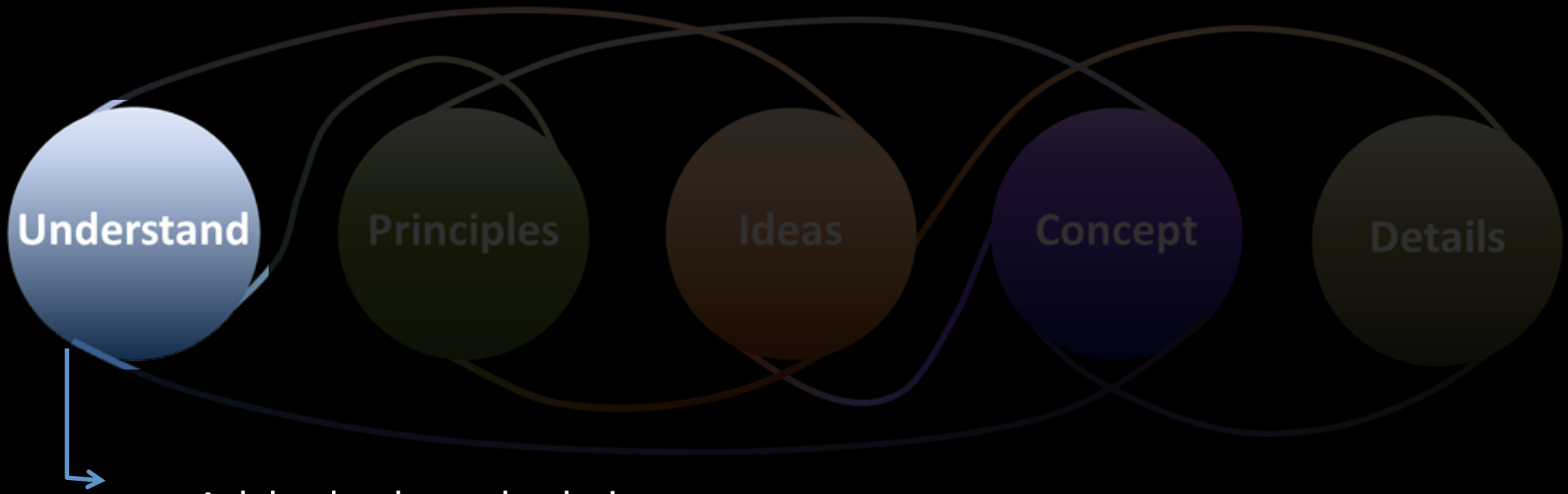
# Spend time understanding the problem




- Ask both what ask why!
- Use ethnographic methods
  - Observations
  - Interviews
  - Data Analysis
  - Need vs. Want

Engineering Innovative Design Process

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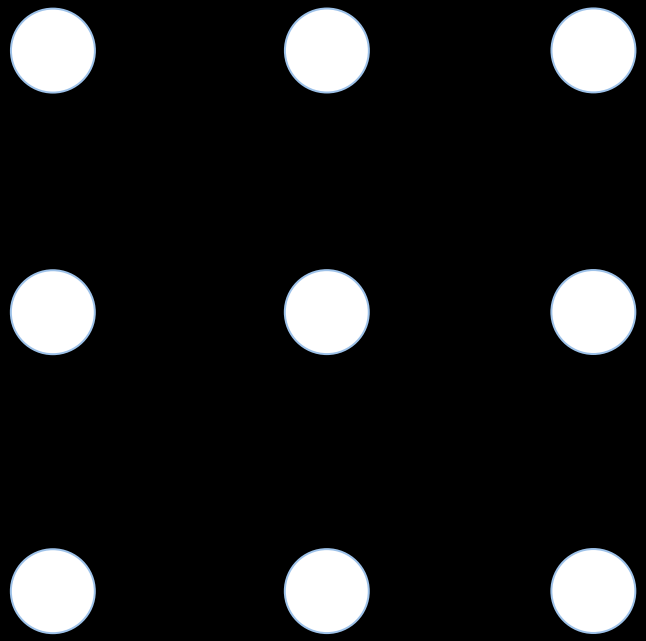
# 2. Look at the problem from different perspectives



Connect the 9 dots drawing four straight, continuous lines that pass through each of the nine dots, and never lifting the pencil from the paper

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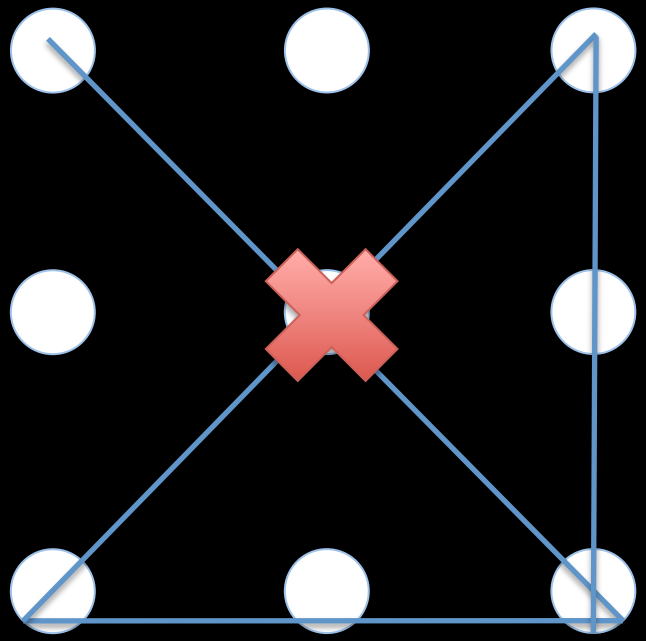

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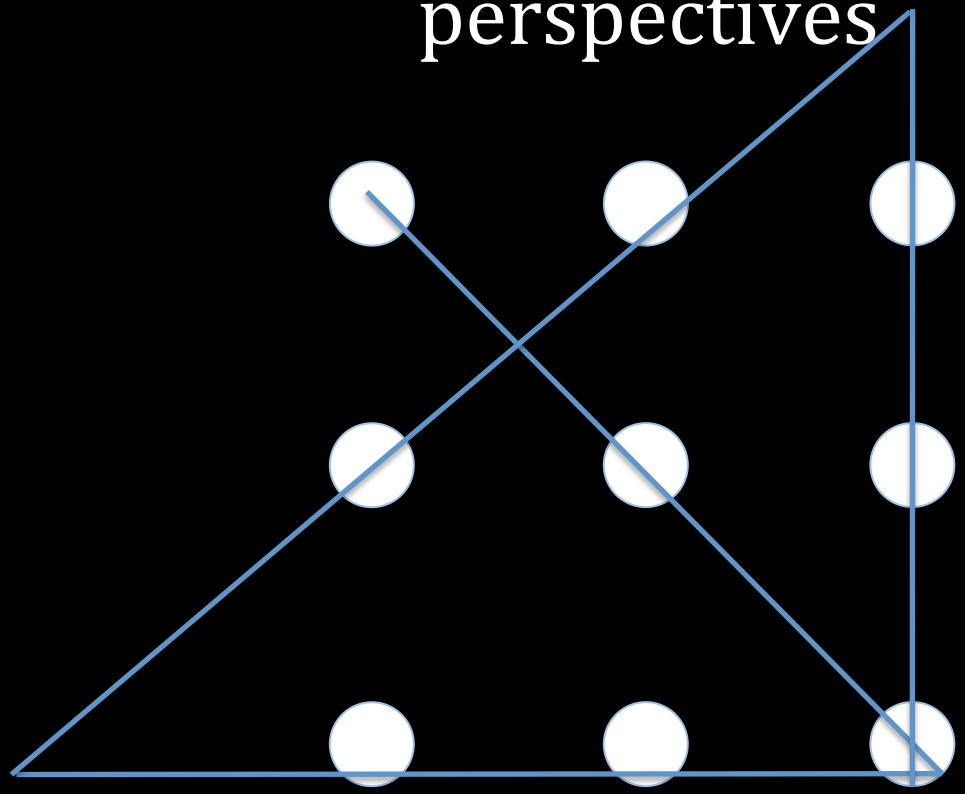

Think outside the box!

Design fixation: a blind adherence to a set of ideas or concepts limiting the output of conceptual design

[Jannson and Smith, 1991]

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# 2. Look at the problem from different perspectives

- Use a variety of Creativity Techniques to encourage 'out of the box' thinking:

  Examples:

  Brainstorming
  C-Sketch
  TRIZ
  Scamper
  6-3-5

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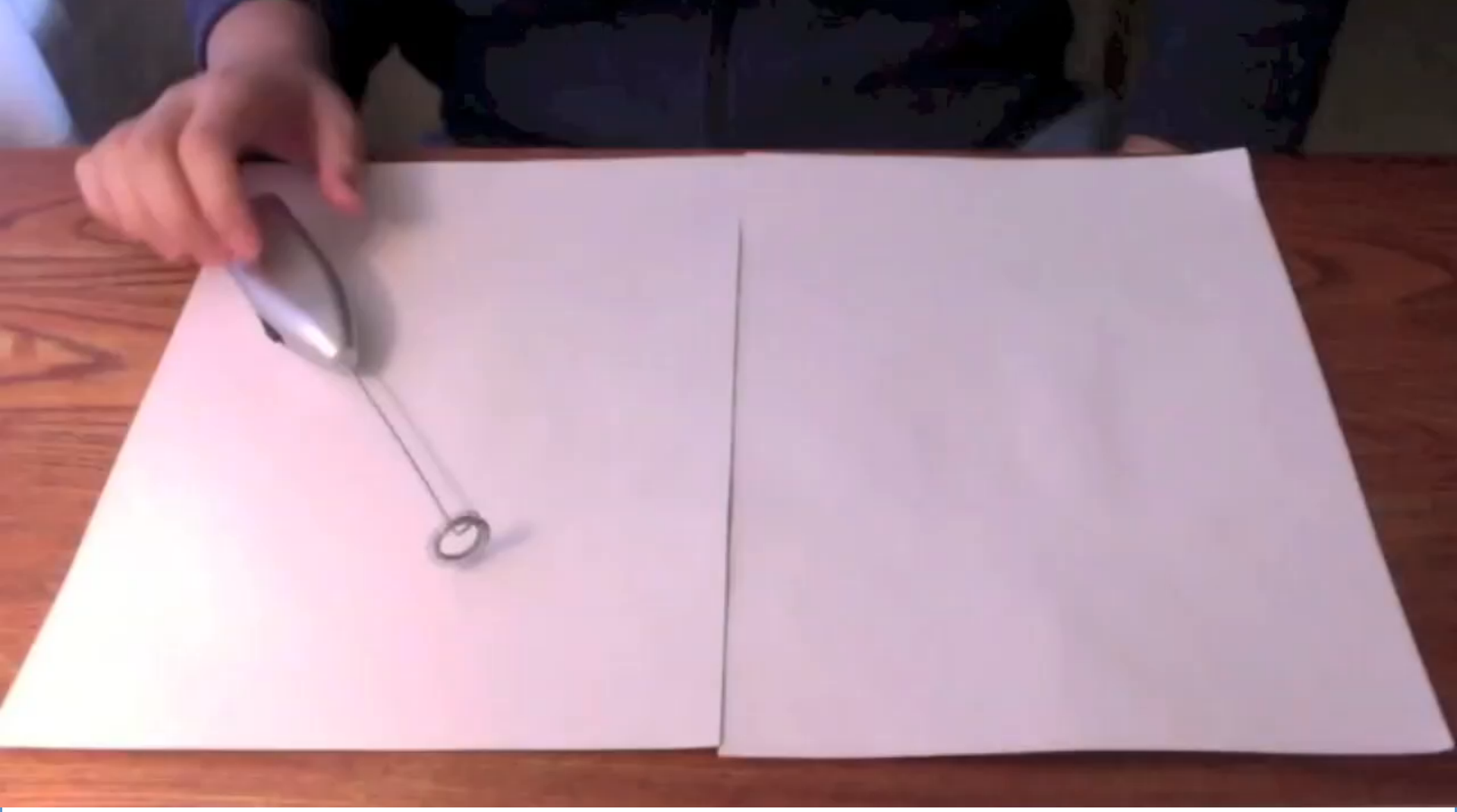
"Too often, the obsession is with 'inventing' something totally unique, rather than extracting value from the creative understanding of what is already known."

—Bill Buxton

[BusinessWeek, Dec 2008]

# Examples are frequently used in design practice



# Product Dissection

## ... helps students understand the product and its properties

[ Wood, 2001;  Lamancusa & Gardner, 1999; Grantham et al., 2010]

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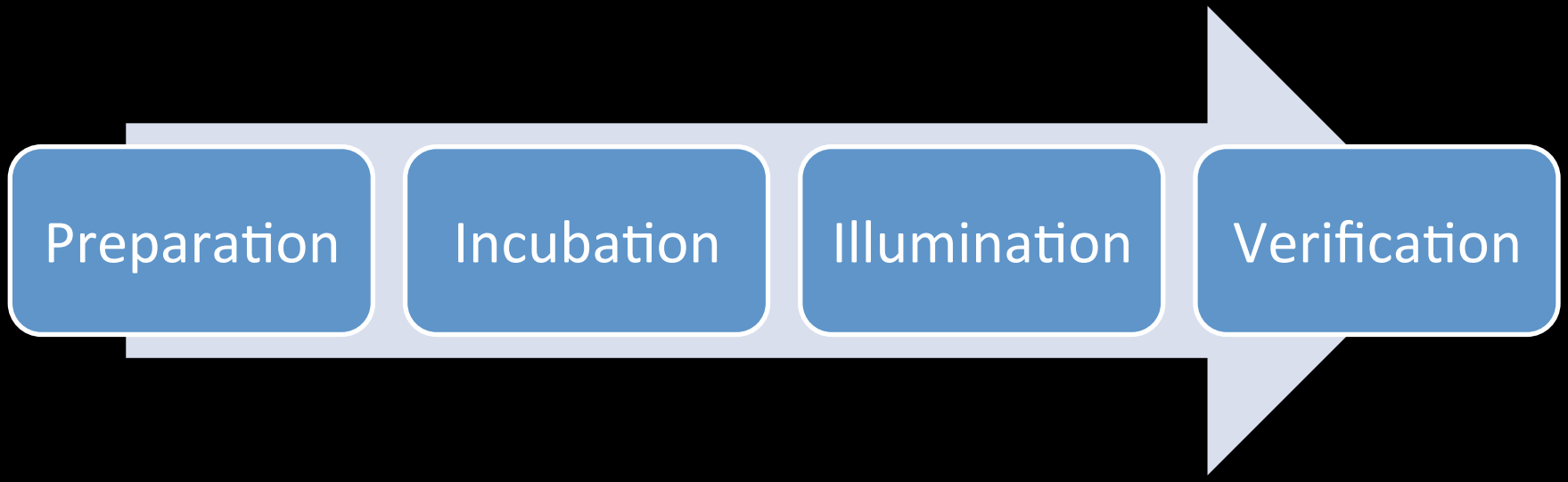
# 3. Spend Time Learning About the World Around you




Wallas (1926)

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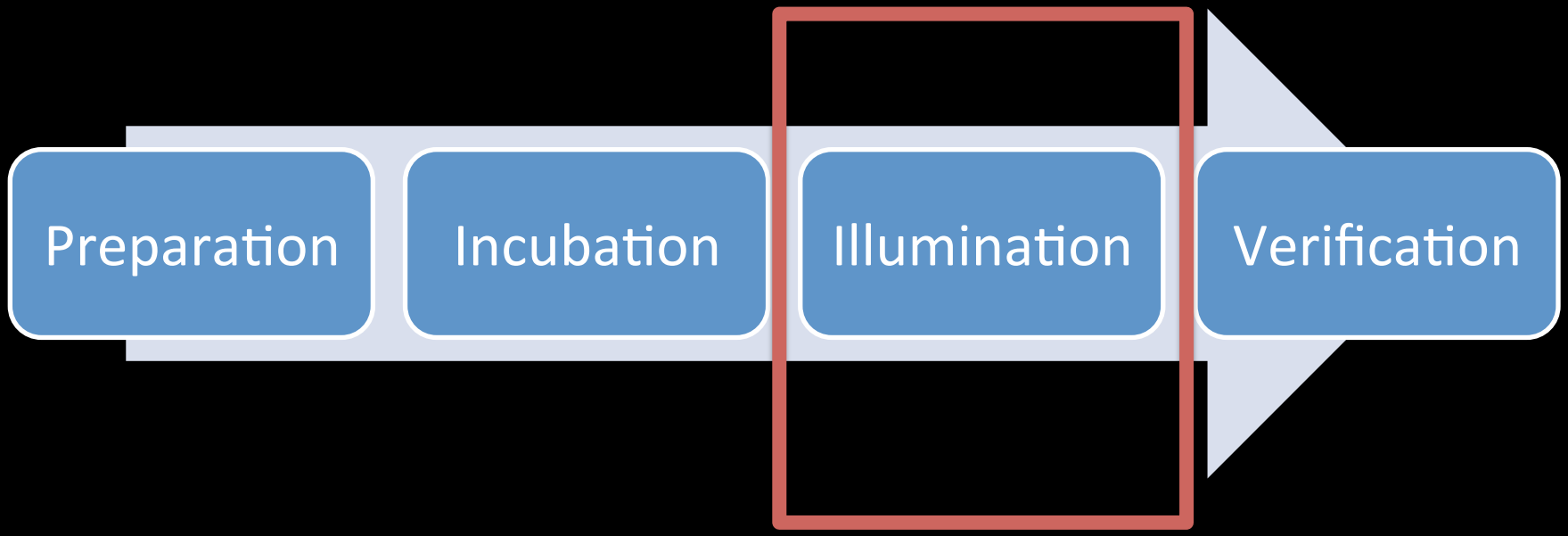


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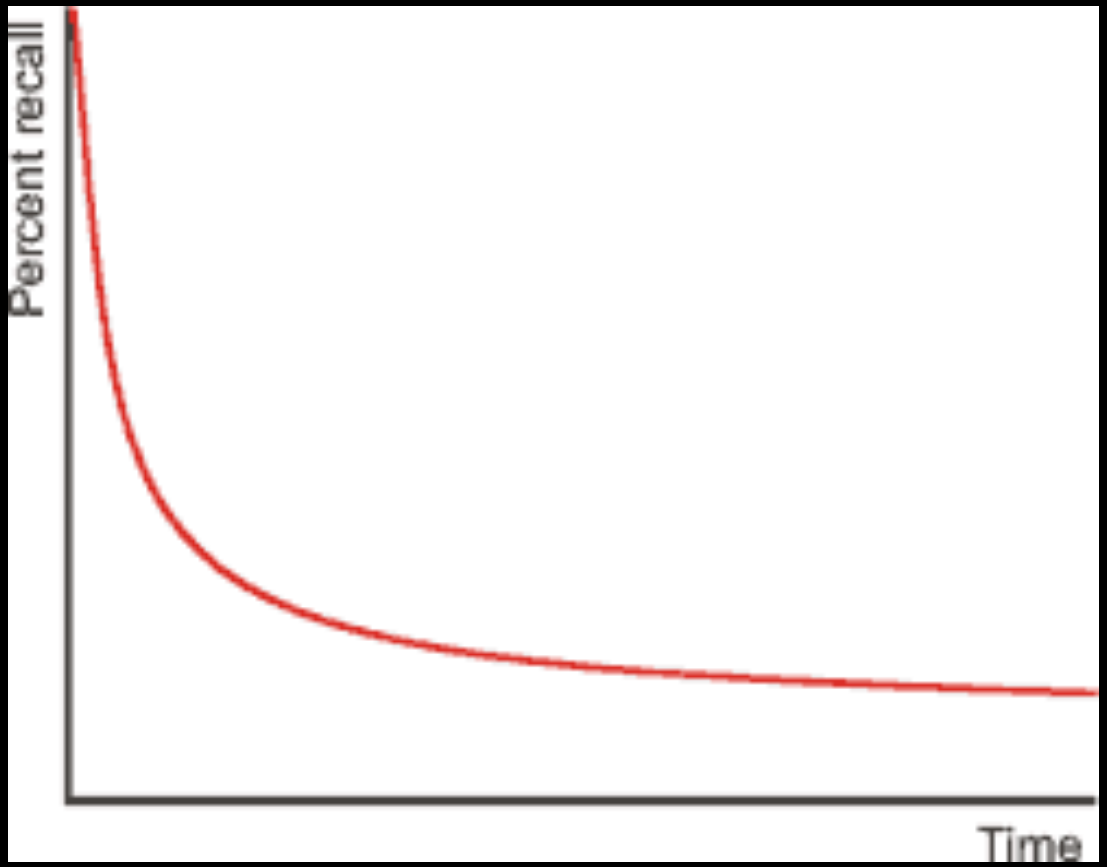


[Ebbinghaus 1985]

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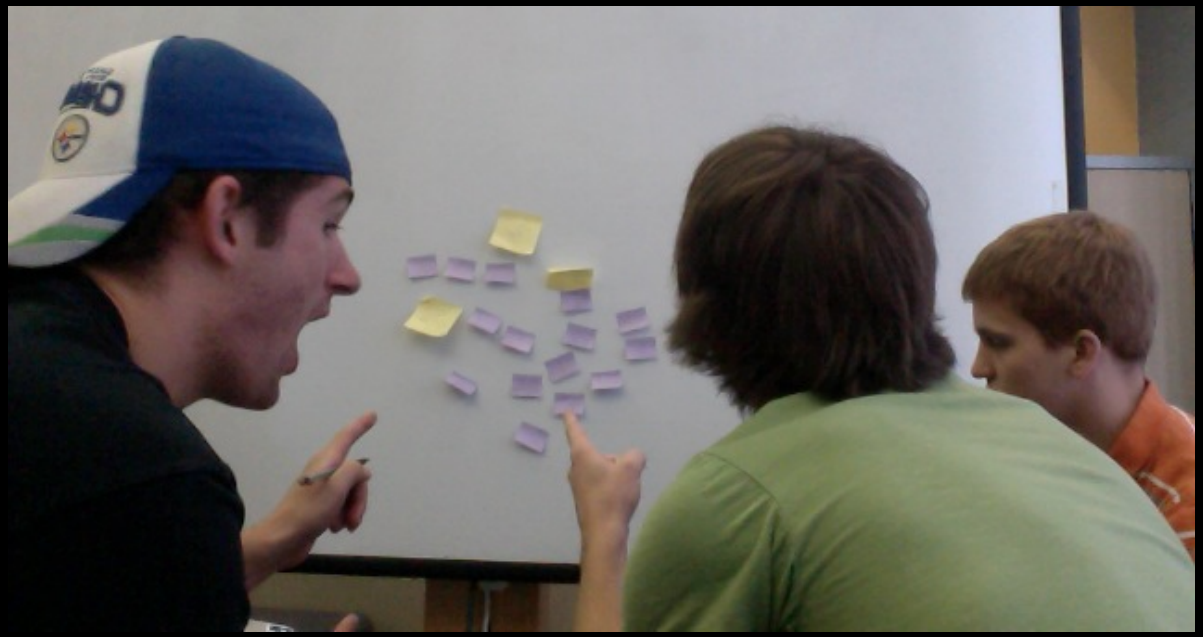
# 4. Work in an inter-disciplinary team

- Spend time understanding the problem
- Look at the design problem from multiple perspectives
- Spend time learning about the world around you



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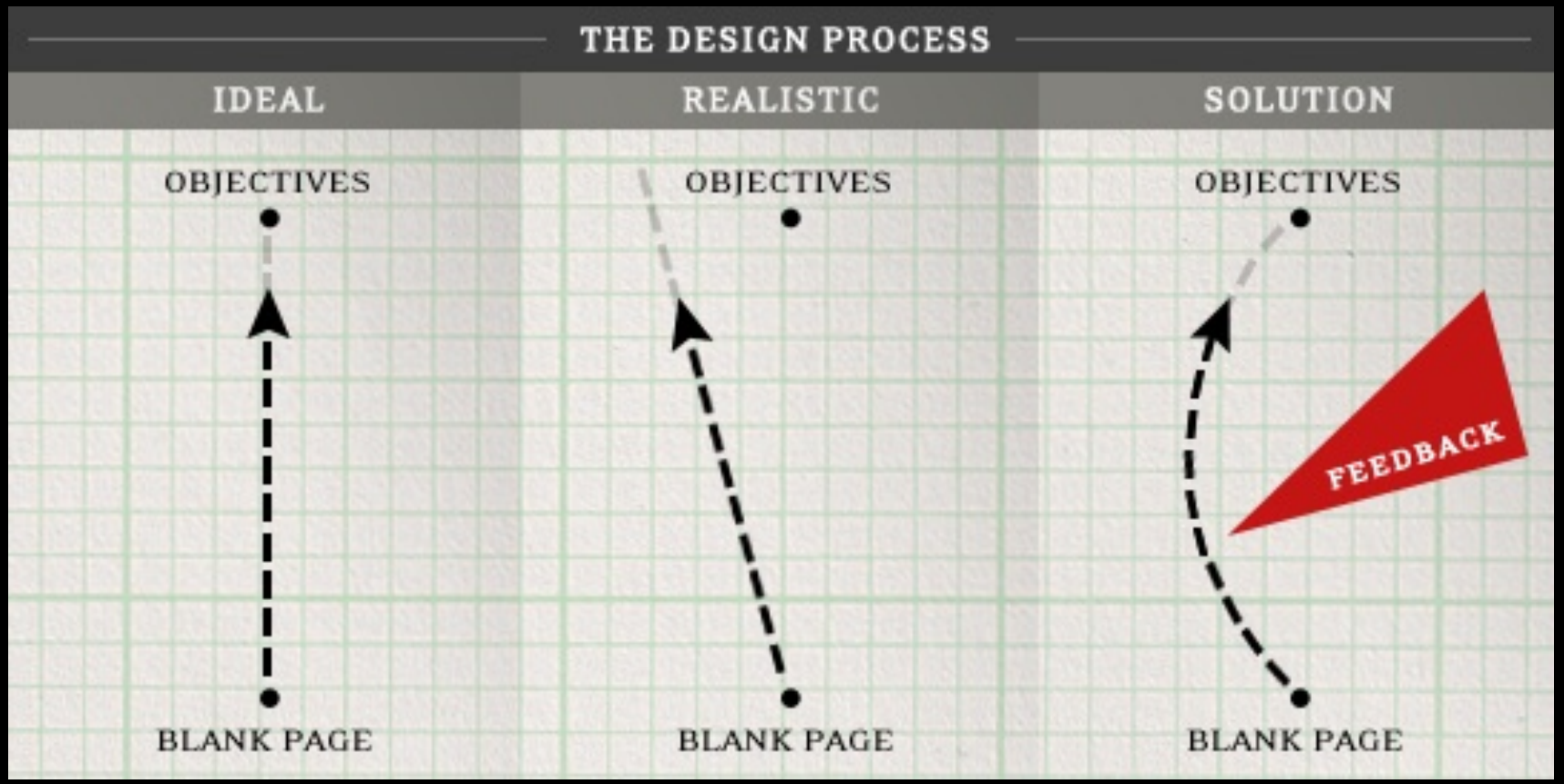
# 4. Work in an inter-disciplinary team




http://www.alistapart.com/articles/design-criticism-creative-process/

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The creative *space*!

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The creative space!

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# 5. Work in a creative environment

The creative atmosphere!

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# References and Resources


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**Hardbolied hat: http://www.halslamppost.com/Miscellaneous%20Mining%20Items/slides/Bullard%20Hard%20Boiled%20Hat%20Ad%201931%20Hendrie%20&%20Bolthoff%20Catalog.htm**

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