

Engineering Intuition

Discussion Facilitator:

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Personal Statement of Belief:

I contend that intuition is a skill that should be developed in a novice engineer.

Basis for Today's Discussion:

In order to aid learners in the development of their intuition, we as teachers must understand what it is.



- **Individual Exercise:**

Recall a particular instance when you used intuition to solve a problem or direct your efforts of inquiry.

- *"messages" about people*
- *repairing a bike light*
- *poor design of brother's garage*



- **Follow-Up Discussion:**

How do you recognize intuition when you use it?

- *a paragraph appears in my mind about someone*
- *I am less analytical*
- *the results are based on my experiences*
- *it feels a little embarrassing because it seems unscientific*
- *the solution comes to me in chunks*



- **Group Discussion:**

How do you define intuition?

How is intuition defined differently in other fields and by other people?

- *ready insight that may be based on experience*
- *connections between things learned in the past*
- *a conclusion that feels right (gut feeling)*
- *pattern recognition*
- *intuition is different for problem solving and interpersonal interaction*
- *systems thinking on a holistic level*
- *experience that has not yet been processed*



Definitions of Intuition

- Intuition as defined by Merriam Webster:

1 : quick and ready insight

2 a : immediate apprehension or cognition

b : knowledge or conviction gained by intuition

c : the power or faculty of attaining to direct knowledge or cognition without evident rational thought and inference

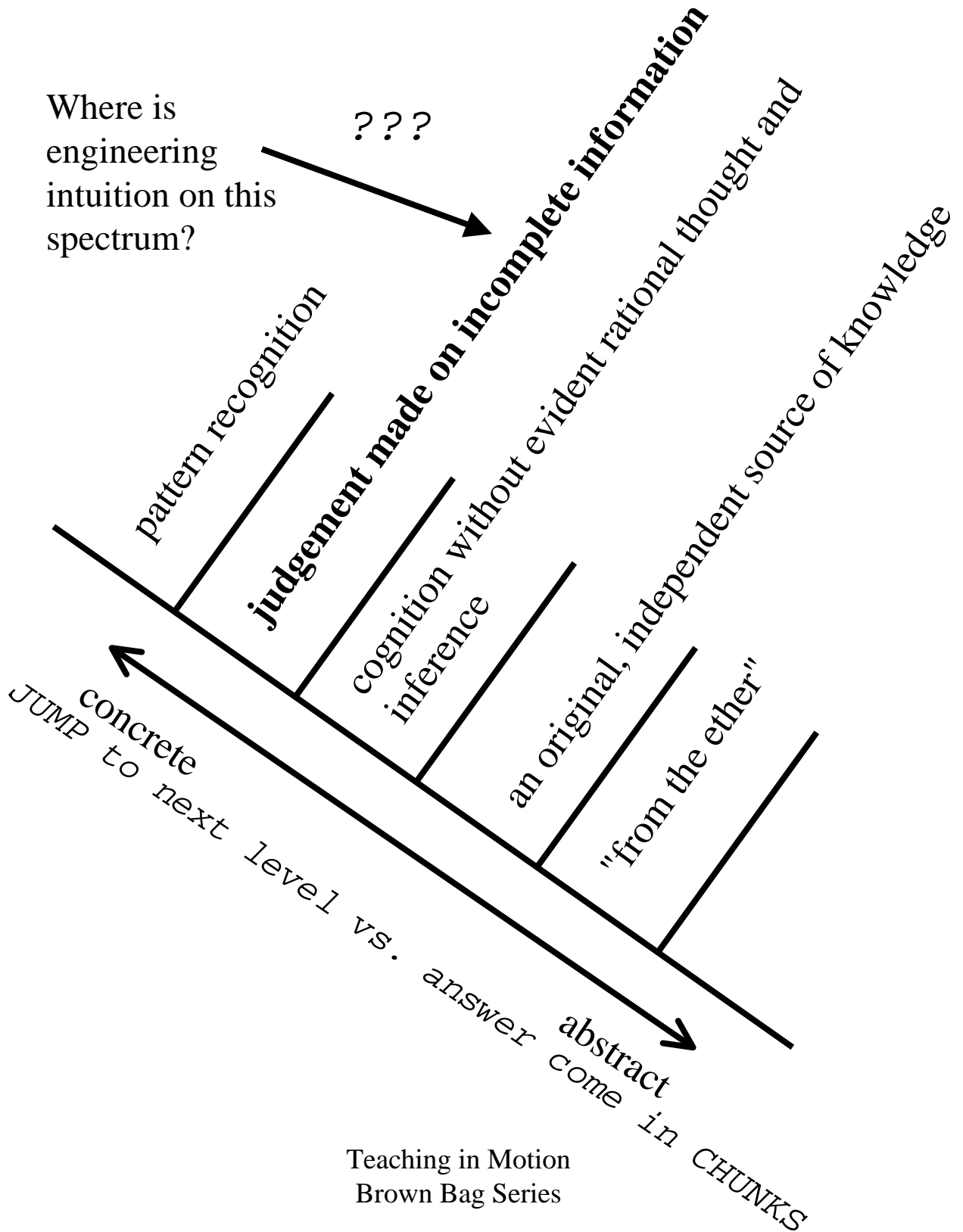
- Intuition discussed in Encyclopaedia Britannica

...the power of obtaining knowledge that cannot be acquired either by inference or observation, by reason or experience. As such, intuition is thought of as an original, independent source of knowledge ...

Definitions of Intuition

Where is engineering intuition on this spectrum?

???





- **Think-Pair-Share Exercise:**

Describe a recent situation in which you were a novice learner.

- **Discussion:**

- How did your skills develop?
- How did you feel being a novice learner?
- When did you develop intuition for the topic?



- **What is is like to be a novice?**

- *awkward*
- *embarrassing*
- *frustrating*
- *fearful*
- *fun*
- *exciting*
- *depressing*
- *out of control*
- *stepping off the
diving board*



- **What does it feel like to use your intuition as a novice?**

- *the light bulb appears*
- *tingling*
- *elation*
- *heartened by even the wrong answer*
- *eager for it to happen again*
- *discouraged*
- *excited about moving to the next step of learning*
- *galvanized to be successful on the next try*



Other Issues That Arise in the Development of Intuition

- **Risk Taking.** Developing intuition involves practice; trial and error. The risk of error is high initially and the learner must overcome their fear of making mistakes and must learn how to gain from the mistakes.
- **Embracing Being Wrong.** The learner must recognize and accept that many mistakes must be made in the development of intuition on a topic. One of the most important aspects of developing intuition is recognizing mistakes and analyzing why they occurred. Adjustments in the learners intuitive feel for a topic can only occur with serious analysis of errors.
- **Practice.** Even after intuition is well developed, we must test it out frequently and regularly in order to maintain it.



Stages of Development


- **The Novice** - The intuitor has a high rate of error but is learning from the outcomes. The intuitor has little sense of the likelihood of a correct decision, and is therefore very uncertain and hesitant about the decision.
- **The Practitioner** - The intuitor loses the ability to explain the reasons why a decision or conclusion has been made. The intuitor has a better feel for the risks associated with their decisions and conclusions; these risks are weighed into the decision making process.
- **The Expert** - The intuitor requires a minimal (and wholly insufficient) information set in order to make a decision or draw a conclusion. Confidence in intuitive ability is such that actions are taken without hesitation. Accuracy is improved and catastrophic errors are avoided.



Issues for Teaching

- **Accepting Intuition as a Valid Problem Solving Method.** Intuition is a way of knowing that is often discounted. When a student is assessed and evaluated on knowledge, intuition is often discounted and considered invalid.
 - **Developing Global Thinkers.** As teachers we often make it our challenge to structure and linearize knowledge, but one of our goals should be to help the student test and develop their intuition. We must cultivate it and be open to accepting it.
 - **Growing the Learner as a Person.** There are several other holistic issues that must be addressed in conjunction with the development of intuition on a topic - the development of voice, and the maturation of the learner.
- *recognizing which problems should and should not be addressed by intuition*

Teaching in Motion
Brown Bag Series



Psychological Type and Learning

Myers-Briggs Type Indicator

- The perceptive function or becoming aware... **intuition**
 - is imaginative, sees possibilities
 - relies on inspiration
 - may be imprecise
 - jumps to solutions
 - works in bursts
 - dislikes routine
- 30% of general population, 47% of engineering students



Teaching Techniques

- intuitive concept formation in the creative problem-solving process (Ali, 1987)
- intuition in the design process (Ramirez, 1994)
- evoking intuition by the integration of dissimilar activities (Brereton et al., 1993)
- concept mapping (deWeijze, 1998)



Teaching References

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Concept mapping for concept engineering

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International Journal of Continuing Engineering Education v 8 n 1-2 1998, p 90-108

Meaningful theory of creativity: design as knowledge: implications for engineering design

Ramirez-Martin-R

Proceedings-Frontiers-in-Education-Conference. 1994, IEEE, Piscataway, NJ, USA 94CH35723. p 594-597.

Exploration of engineering learning

Bretton-Mirgot-F; Leifer-Larry-J; Greeno-James; Lewis-Jason; Lindt-Charlotte


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Teaching Techniques

- *ask students to think about whether or not their answer is reasonable*
- *ask students to make a guess about the answer before they tackle the problem, and then check back with the guess after the problem is solved*
- *use brainstorming*
- *develop interpersonal intuition in team projects*
- *look for analogous situations in nature*
- *openly encourage students to use their intuition*

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- **How do we know whether or not our teaching techniques are working?**
 - **How do we assess the development of intuition?**



Measuring the Development of Institution

Some scales upon which the measurement of institution can take place:

- ability to recognize that not all facts are needed to make a decision
- comfort with relying on intuition
- confidence in intuitively reached outcomes
- purposefulness in the development of intuition