

# Systems Engineering High Level Overview

Note: These are Colleen's perspectives and do not necessarily represent the Boeing Company point of view

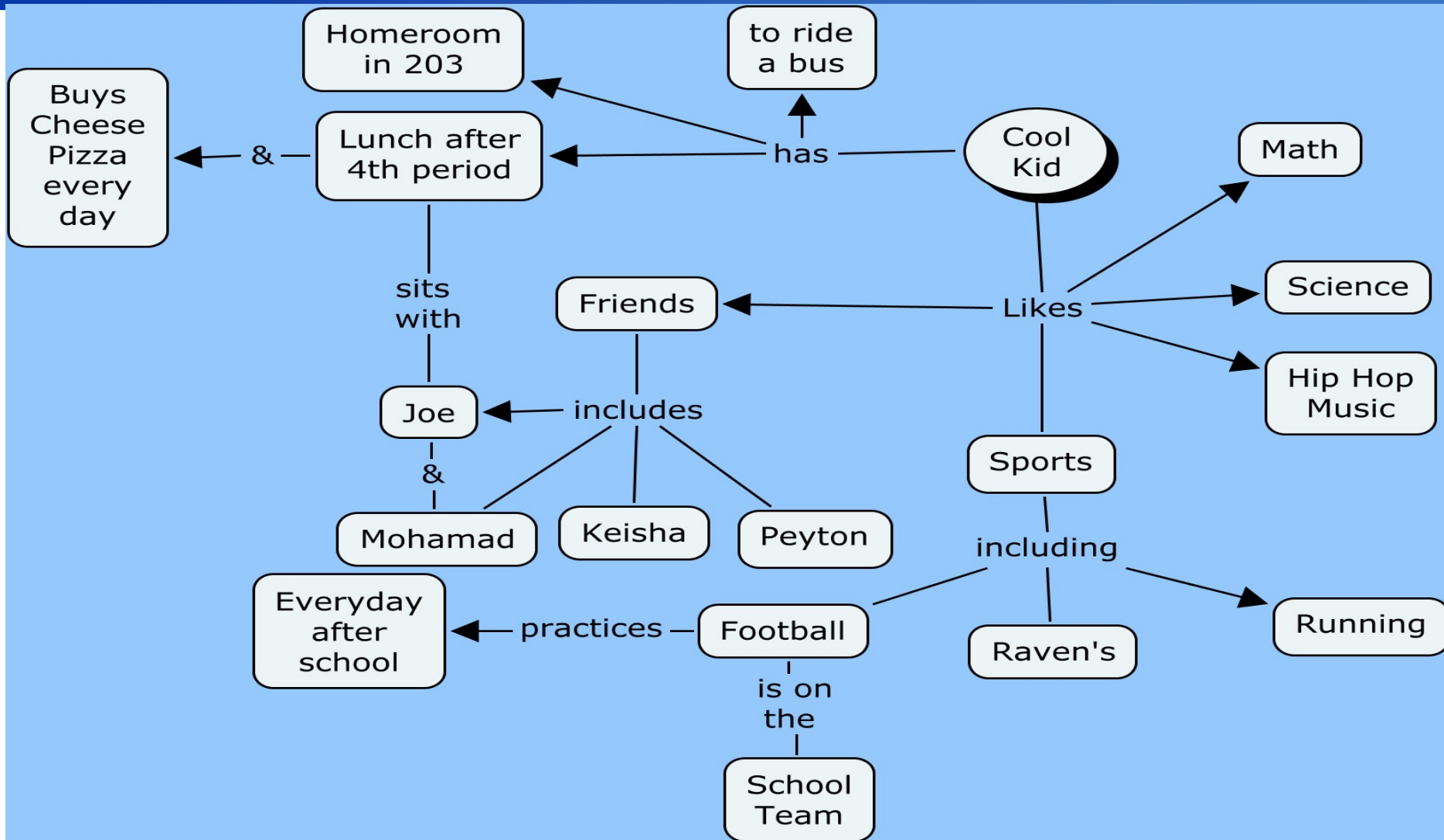


# Needs are Requirements

**A good requirement is something that:**

- 1) is needed,**
  - 2) can be tested to make sure you met the need, and**
  - 3) is something you can make happen**
- (It isn't too hard to build, won't take too long, or cost too much).**

# What Do You Notice?







# What is a System?

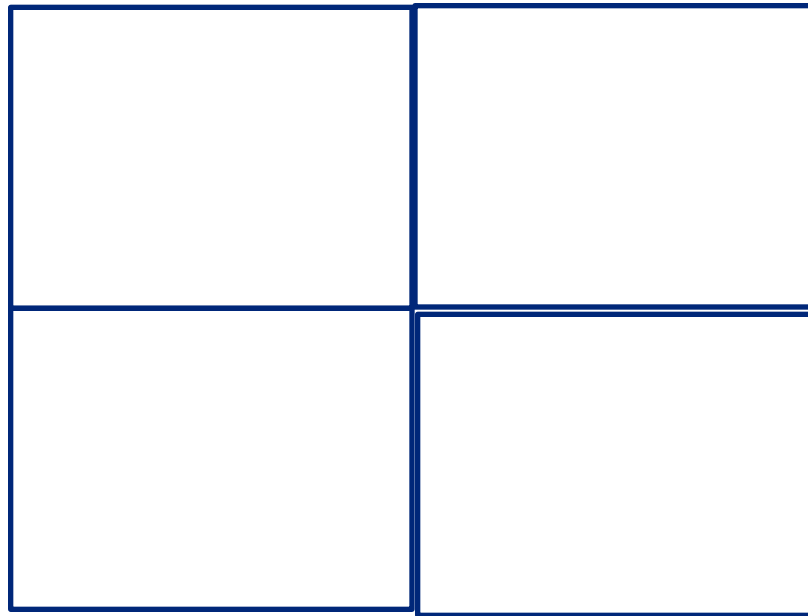
PURPOSE

CONTROL/TRIGGER

SUPPORT ELEMENTS

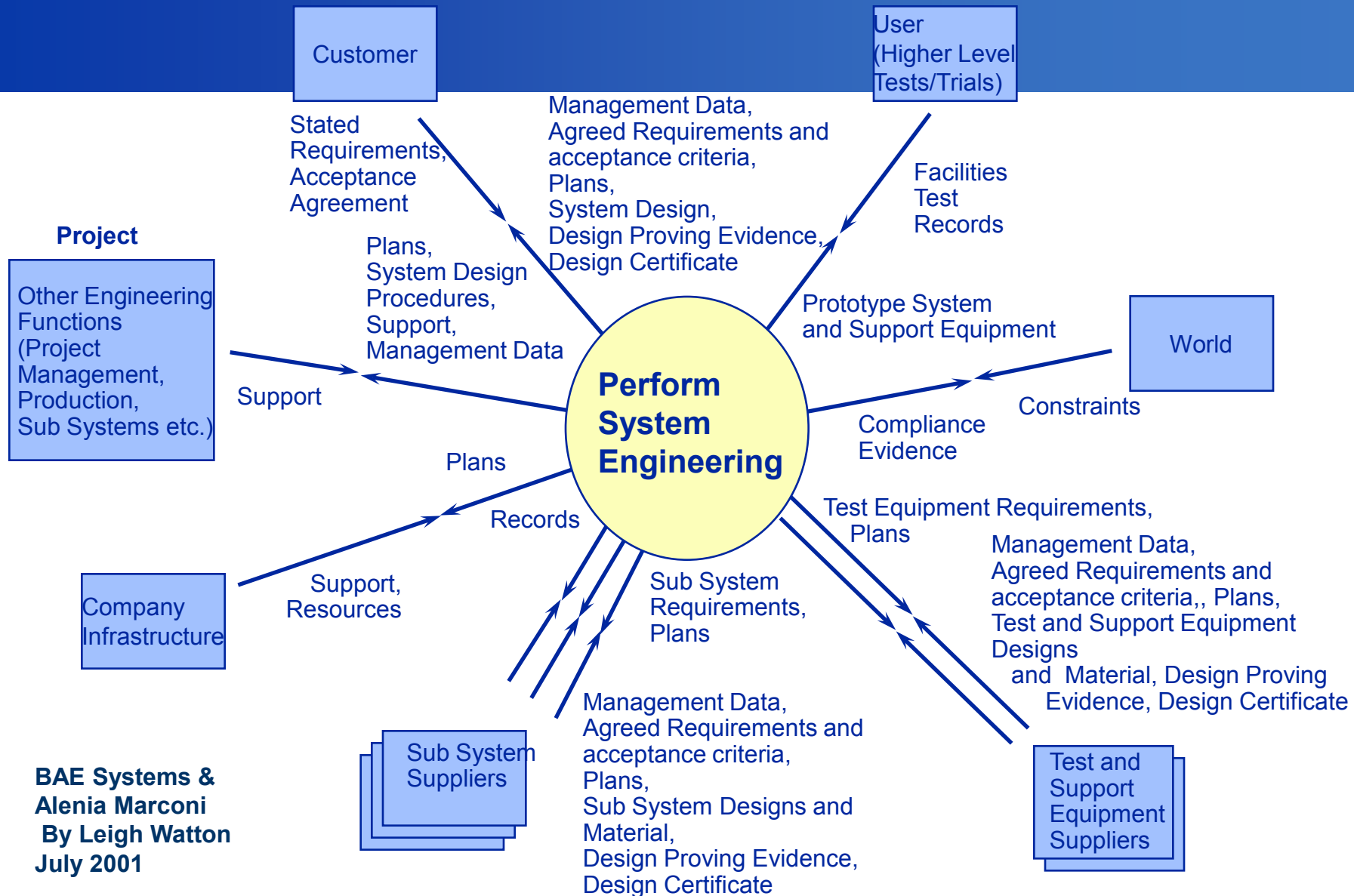
INPUT/OUTPUT

Colleen Calimer/John BeVier definition



COULD INCLUDE A DEPICION OF ONE OF THE SYSTEMS (OR SUB-SYSTEMS AS PART OF THEIR CLUDES – would list person/people and who they are influencing or “attacking” etc.

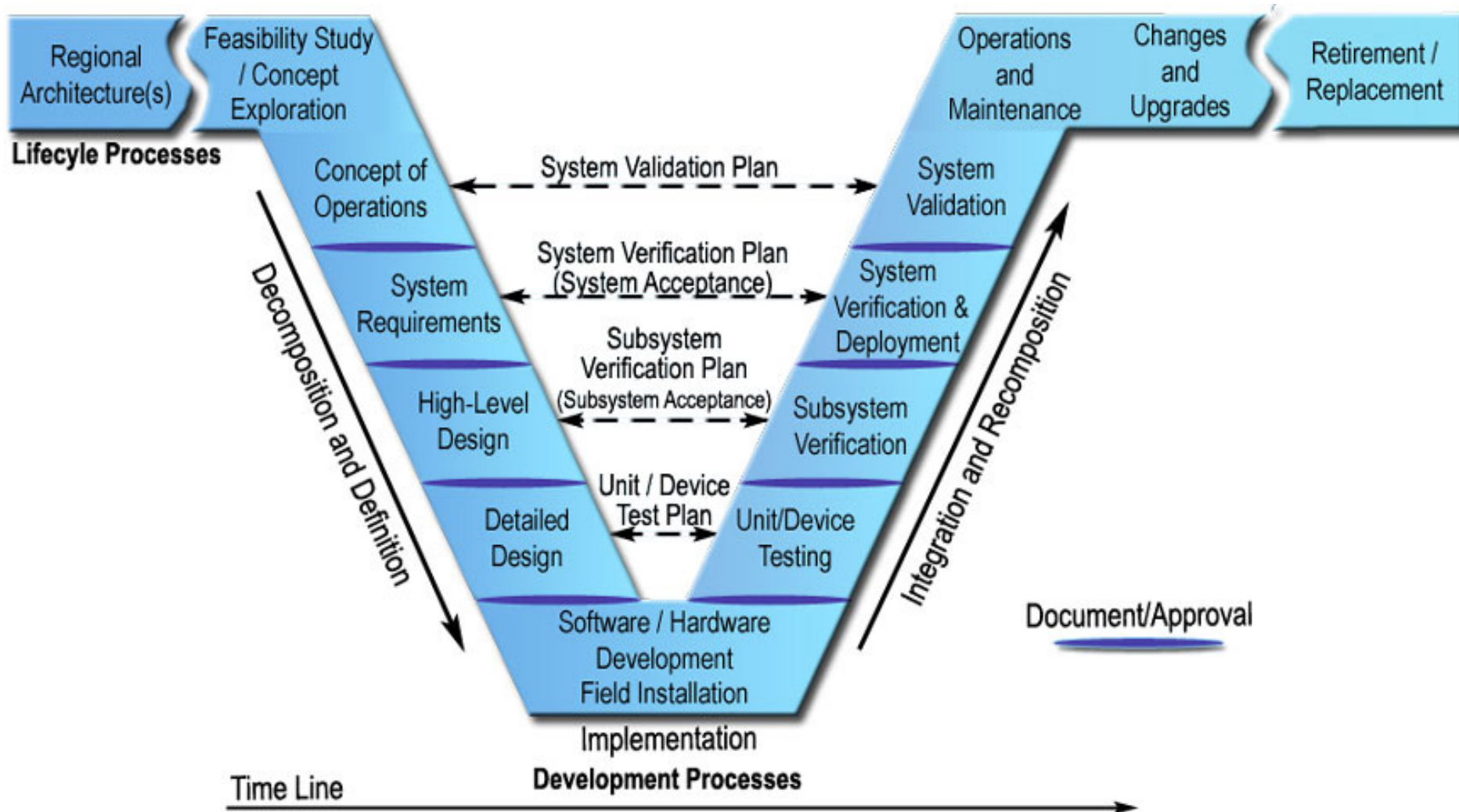
# System Engineering Context Diagram



**BAE Systems &  
Alenia Marconi  
By Leigh Watton  
July 2001**



# Classic “V” Diagram



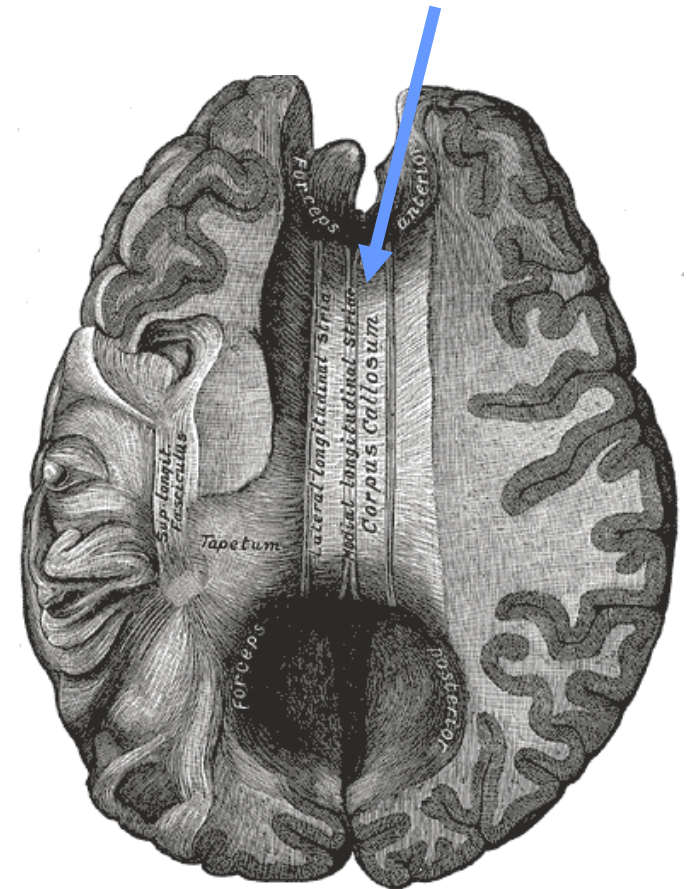


# Good System Engineers (SEs) Use Both Sides of Their Brains – You Probably do Already

- The corpus callosum attaches the left brain hemisphere to the right brain hemisphere so they can “talk to one another”.
  - Left brain: mathematical, logical, deductive
  - Right brain: aesthetic, intuitive, inductive
- SEs must be able to use **both** sides of their brain, and be able to switch back and forth between them.
  - Can consider the technical issues as well as be visionary
  - Can be creative with new mission designs, but pay attention to costs and reality
- SEs need to be a “visionary skeptic.”
  - Sometimes the intuitive burst needs to pass over to the skeptic and ask how much it will cost, or if it is even possible. (refer back to needs/requirement).

**YOU CAN USE BOTH SIDES – EITHER NATURALLY, OR BE TAUGHT**

*SE When the Canvas Is Blank*  
by B. Gentry Lee, 2007



Gray's Anatomy Fig. 733

09/24/2009

# Use both sides of the brain / switch back & forth

## LEFT BRAIN

Logic  
Details  
Facts Rule  
Words & Language  
Present & Past  
Math and Science  
Order/Pattern  
Reality Based  
Forms Strategies  
Practical  
Safe

## RIGHT BRAIN

Feeling  
“Big Picture”  
Imagination Rules  
Symbols & Images  
Present & Future  
Philosophy & Religion  
Spatial Perception  
Fantasy Based  
Presents Possibilities  
Impetuous  
Risk Taking

*Using both  
sides can be  
learned and  
it creates a  
more  
powerful  
You!*

**Visionary & Technical; Creative but cost-conscious; Inventive yet possible**

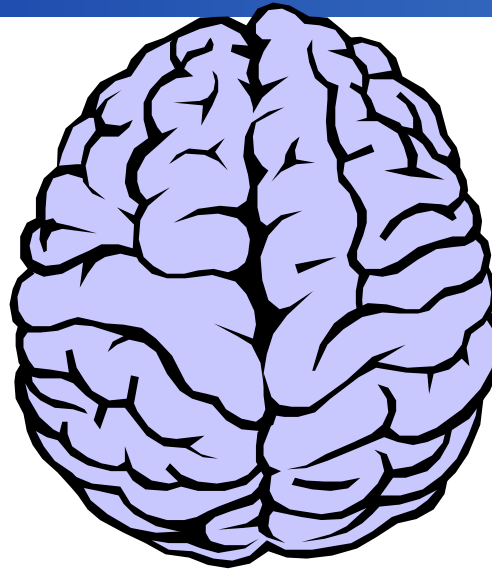
SE When the Canvas is Blank by B. Gentry Lee, 2007le

BOEING PROPRIETARY

# Two Hemispheres of the Brain (1)

## Left Hemisphere of Brain L-Directed Thinking

- Uses logic
- Detail oriented
- Facts rule
- Words and language
- Present and past
- Math and science
- Can comprehend
- Knowing
- Acknowledges
- Order/pattern perception
- Knows object name
- Reality based
- Forms strategies
- Practical
- Safe



<http://www.news.com.au/perthnow/story/0,,22492511-5005375,00.html?from=valueAdd>

## Right Hemisphere of Brain R-Directed Thinking

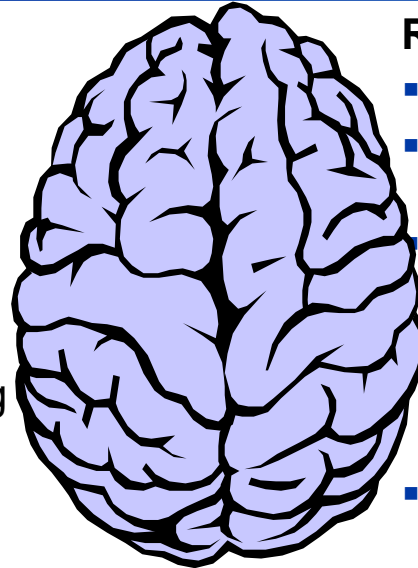
- Uses feeling
- “Big picture” oriented
- Imagination rules
- Symbols and images
- Present and future
- Philosophy and religion
- Can “get it”, i.e., meaning
- Believes
- Appreciates
- Spatial perception
- Knows object function
- Fantasy based
- Presents possibilities
- Impetuous
- Risk Taking

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# Two Hemispheres of the Brain (2)

## Left Hemisphere of Brain

- Controls right side of body
- Sequential – recognizes serial events
- Logical, rational
- Verbal activities
  - Talking, understanding speech, reading and writing
- Specializes in text – *what is said*
  - Objective
  - Literal meaning
- Analyzes the details (parts)
  - Analyzes information
  - Breaks the whole into parts
  - Converges on a single answer
  - Focuses on categories
  - Grasps details



Daniel Pink, *A Whole New Mind: Why Right-Brainers Will Rule The Future*, Riverhead Books, New York, ISBN 1-57322-308-5, ©2006

## Right Hemisphere of Brain

- Controls left side of body
- Simultaneous – sees many things at once
- Intuitive, aesthetic
- Non-verbal activities
  - Recognizes and interprets facial expressions, intonation & emotional cues
- Specializes in context – *how it is said*
  - Subjective
  - Comprehends metaphors
- Synthesizes the “big picture” (whole)
  - Puts isolated elements together to perceive things as a whole (holistic)
  - Diverges into a Gestalt (organized whole)
- Focuses on relationships
- Sees the “big picture”

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