Innovation in Nursing

Andrei Cernasov, PhD
Energy Levels, Focus, and Motivation Over An Average Day

- Energy
- Focus
- Motivation
Energy Levels, Focus, and Motivation Over An Average Day

- Energy
- Focus
- Motivation

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Defense Innovations

internet
cellular communication
gps
microchips
siri
touchscreen

all government funded
Fundamentals of Innovation
Everyone Loves Innovation!!
Everyone Loves Innovation ?!

Boudreau, et al
Everyone Loves Innovation ?!

Boudreau, et al
Everyone Loves Innovation ?!

Boudreau, et al
“I want you to find a bold and innovative way to do everything exactly the same way it’s been done for 25 years!”
The Definition of Innovation
A Device or Process that is New, Non-Obvious and Useful to Many
Definition: Innovation

A Device or Process that is New, Non-Obvious and Useful to Many
Everyone is Creative !!
Let’s Solve an Important Problem!!
# 2017 Hospital National Patient Safety Goals

The purpose of the National Patient Safety Goals is to improve patient safety. The goals focus on problems in healthcare safety and how to solve them.

## Identify patients correctly

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<tr>
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<tbody>
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<td>NPSG.01.01.01</td>
<td>Use at least two ways to identify patients. For example, use the patient's name and date of birth. This is done to make sure that each patient gets the correct medicine and treatment. Make sure that the correct patient gets the correct blood when they get a blood transfusion.</td>
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## Improve staff communication

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<td>NPSG.02.03.01</td>
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## Use medicines safely

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<td>Before a procedure, label medicines that are not labeled. For example, medicines in syringes, cups and basins. Do this in the area where medicines and supplies are set up.</td>
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<td>Take extra care with patients who take medicines to thin their blood.</td>
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## Problems

### 2017 Hospital National Patient Safety Goals

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How????
Think Outside the Box!!!
The Biology of Innovation
Biology of Innovation

• What is the “Box”?  
• “Box” Special Effects  
• “Box” Hardware  
• Changing the “Box”
What is the “Box”?
What is the “Box”? 

The “Box” is the neural and cognitive model each of us have of the surrounding world.
What is the “Box”? 

The “Box” is the neural and cognitive model each of us have of the surrounding world. 

Therefore “Think Outside the Box” is an Oxymoron.
“Box” Special Effects
“Box” Special Effects
“Box” Special Effects

2.5D TV !!
How many inches in a league?

Metric System

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Symbol</th>
<th>Multiplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>exa</td>
<td>E</td>
<td>$10^{18}$</td>
</tr>
<tr>
<td>peta</td>
<td>P</td>
<td>$10^{15}$</td>
</tr>
<tr>
<td>tera</td>
<td>T</td>
<td>$10^{12}$</td>
</tr>
<tr>
<td>giga</td>
<td>G</td>
<td>$10^9$</td>
</tr>
<tr>
<td>mega</td>
<td>M</td>
<td>$10^6$</td>
</tr>
<tr>
<td>kilo</td>
<td>k</td>
<td>$10^3$</td>
</tr>
<tr>
<td>hecto</td>
<td>h</td>
<td>$10^2$</td>
</tr>
<tr>
<td>deka</td>
<td>da</td>
<td>$10^1$</td>
</tr>
<tr>
<td>deci</td>
<td>d</td>
<td>$10^{-1}$</td>
</tr>
<tr>
<td>centi</td>
<td>c</td>
<td>$10^{-2}$</td>
</tr>
<tr>
<td>milli</td>
<td>m</td>
<td>$10^{-3}$</td>
</tr>
<tr>
<td>micro</td>
<td>μ</td>
<td>$10^{-6}$</td>
</tr>
<tr>
<td>nano</td>
<td>n</td>
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<tr>
<td>pico</td>
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<tr>
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<tr>
<td>atto</td>
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A Travelling Salesmen Problem!!
Three travelers arrive at a hotel and rent three rooms for $10 each.
They give the clerk $30 and go to their rooms.
The clerk realizes that, since they travel as a group, the travelers are entitled to a $5 discount.
The clerk gives the bellboy $5 to give back to the travelers
The bellboy returns $1 to each traveler and keeps $2 for himself.
So each traveler pays $9 for his room and the bellboy pockets $2.
3 \times \$9 + \$2 = \$29

Where is the 30th dollar?
“Box” Hardware

• Genetics
• The Neuron
• The Speed of Thought
• The World Model
Genetics
Genetics
# Genetics

## Familial IQ Correlations - Reared Together Biological Relatives

<table>
<thead>
<tr>
<th>Relationship</th>
<th>Average IQ Correlations</th>
<th>Number of Pairs Tasted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identical Twins</td>
<td>0.86</td>
<td>4672</td>
</tr>
<tr>
<td>Same Sex Fraternal Twins</td>
<td>0.60</td>
<td>5533</td>
</tr>
<tr>
<td>Siblings</td>
<td>0.47</td>
<td>26473</td>
</tr>
<tr>
<td>Parent-Offspring</td>
<td>0.42</td>
<td>8433</td>
</tr>
<tr>
<td>Half-Siblings</td>
<td>0.35</td>
<td>200</td>
</tr>
<tr>
<td>Cousins</td>
<td>0.15</td>
<td>1176</td>
</tr>
</tbody>
</table>

McGue, Bouchard, Iacono, Lykken - 1993
The Neuron

- Basic Building Block
- Average Brain has roughly 100 billion neurons
- Each Neuron has, on the average, 7000 Synapses
- Signals Travel at 1 to 100 meters/second
- Synapse Time 2 ms to 0.5 s.
- Brain Power Use: 20 W
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The human brain is Very Energy Efficient
The Speed of Thought

• Basic Building Block
• Average Brain has roughly 100 billion neurons
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• Signals Travel at 1 to 100 meters/second
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• Brain Power Use: 20 W

The human brain is
VERY, VERY SLOW!!!
But the human brain must also be VERY, VERY FAST!!!

Ball Speed 100 mph = 147 ft/s
Pitcher-Home Plate distance = 60 ft
Ball Travel Time = 0.4 seconds
The Speed of Thought

10000 Hours Rule

“The emerging picture from studies is that 10,000 hours of practice is required to achieve the level of mastery associated with being a world-class expert – in anything”

Original quote comes from neurologist Daniel Levin.
The Speed of Thought

10000 Hours of Play & Practice
The Speed of Thought

Sensor Triggered Recall & Adjustment

10,000 Hours

Neural Networks Set (The “Box”)

Neural Model Building
At any given time we are operating within the constraints of our current set of interconnected neural networks, i.e. our World Model.

This set contains a functional summary of our past experiences. This IS “The Box”!

The “Box” is an efficient model of the surrounding world.
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The “Box” is an efficient model of the surrounding world.
Changing the “Box”

- Neuroplasticity
- Sleep and Creative Thinking
- Mind Wondering and Creative Thinking
- Conclusions
Neuroplasticity

• Violinists and Braille readers have a physically larger representation of their left fingers on their somatosensory (touch) cortex
• The auditory cortex of experienced Musicians can be 25% or more larger than that of non-musicians
Neuroplasticity

London Cab Drivers Study

Drivers: 16
Mean Age: 44
Range: 32 to 62
Experience: 1.5 to 42
Training: 2 years

Eleanor A. Maguire – Navigation related structural change in the hippocampi of taxi drivers – University College London 2000
Mind Wandering and Creative Thinking

• Neural patterns of Mind Wandering without meta-awareness similar to those observed during Creative Thinking experiments
• Parallel operation of Executive and Default networks

Kalina Christoff – Experience sampling during fMRI reveals default network and executive system contributions to mind wandering
PNAS – May 26, 2009 – Vol 106 no. 21
Mind Wandering and Creative Thinking

Mozart  Einstein  Galileo  Darwin  Newton

Leonardo  Neil Simon  Tchaikovsky  Poincare  Maxwell
Sleep and Creative Thinking

• When a new problem is submitted to the brain the network library (the “Box”) is scanned for existing encoded solutions
• If no stored solution is found the problem is dropped or the building of a new neural network (new Model) commences

The Tower of Hanoi

• Only one disk may be moved at a time.
• Each move consists of taking the upper disk from one of the poles and sliding it onto another pole, on top of the other disks that may already be present on that pole.
• No disk may be placed on top of a smaller disk.
Sleep and Creative Thinking

Sleep-Dependent Memory Consolidation – Robert Stickgold, Nature October 2005

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Sleep and Creative Thinking

August Kekule

Elias Howe

Dr. Otto Loewi

Srinivasa Ramanujan

Robert Louis Stevenson

Stephen King

“Salem’s Lot”
Conclusions

• “Think Outside the Box” is an Oxymoron to be replaced by “Expand Your Box”
• “Expand Your Box” requires the development of new neural networks
• Building neural networks requires time (days to years) and inflow of new information. This information can be acquired through collaboration among creative people - Teams
• Leading edge creativity is a full time activity. Competing neural nets will cannibalize idle developing nets through synapse pruning
• Creative potential is enhanced during Mind Wondering (relaxed idling) New World Model systems (neural networks) are consolidated into the memory matrix during Sleep Cycles
• Occasionally full problem simulations, including solutions, are performed during Sleep Cycle sets (weeks to years)
• Creativity can be enhanced through the reduction of non-creative stimuli
Problems, Needs and Opportunities
Problems, Needs and Opportunities

If I had only one hour to save the world, I would spend fifty-five minutes defining the problem, and only five minutes finding the solution.

— Albert Einstein —
Problems
Problems

**Problem** — measured by the departure of the *Current Negative Outcome* from an *Expected Positive Outcome*
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<tr>
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<td>Make improvements to ensure that alarms on medical equipment are heard and responded to on time.</td>
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<th>Prevent infection</th>
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<td>Use the hand cleaning guidelines from the Centers for Disease Control and Prevention or the World Health Organization. Set goals for improving hand cleaning. Use the goals to improve hand cleaning.</td>
</tr>
<tr>
<td>NPSG.07.03.01</td>
</tr>
<tr>
<td>Use proven guidelines to prevent infections that are difficult to treat.</td>
</tr>
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<tr>
<td>Use proven guidelines to prevent infection of the blood from central lines.</td>
</tr>
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<tr>
<td>Use proven guidelines to prevent infection after surgery.</td>
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<td>Use proven guidelines to prevent infections of the urinary tract that are caused by catheters.</td>
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<tr>
<td>Find out which patients are most likely to try to commit suicide.</td>
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<tr>
<td>Make sure that the correct surgery is done on the correct patient and at the correct place on the patient's body.</td>
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<tr>
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<tr>
<td>Mark the correct place on the patient's body where the surgery is to be done.</td>
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<td>Pause before the surgery to make sure that a mistake is not being made.</td>
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Problems Process

- Identify Perceived Problem
- Define Real Problem
- Find Root Cause of the Problem
- Define Underlying Contradiction
- State the Final Problem
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➤ Incomplete Data Entries
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- Incomplete Data Entries
- Task Overload
- Compliance Requirements
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- Task Overload
- Compliance Requirements
- Legal Tasking vs. Resourcing

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➢ Task Overload
➢ Compliance Requirements
➢ Legal Tasking vs. Resourcing
➢ Unbalanced Resource Allocation
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Unbalanced Resource Allocation