Problem Formulation
The unrecognized core of critical thinking

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Welcome!

► Please pair up with and introduce yourself to the person sitting next to you and …
  ➢ share the most recent appreciation that you received at work.
  ➢ If it has been more than a year since receiving one please ask if they want a hug.

► Identify a recent situation which in retrospect, you wish that you had thought more critically.
  ➢ Please share that story with your partner (feel free to anonymize it to feel comfortable sharing).
Agenda

▶ How did I get involved in critical thinking?
▶ What’s brain science got to do with it?
▶ A general method for formulating the “right” problem the first time
▶ Some educational resources
▶ Key take-aways

Why critical thinking?
(How did I get involved?)
Why critical thinking?

- Recruiters said Olin MBAs are poor communicators and poor analytical thinkers
- Dean charged me to lead a committee
- We discovered that critical thinking was the missing skill. However, …
  …we realized this missing skill wasn’t logic.
- Result: Developed a “new” approach
  - Olin moved from ~30 to top 5 in employment 90-days after graduation
- What is the new approach to critical thinking?

Branches of critical thinking

- Logical reasoning
- Comprehensively formulating and overcoming thinking traps
An illustration

What's brain science got to do with it?

(Quite a lot)
Why isn’t critical thinking easy?

- Ill-defined, ill-structured, messy complex problems are difficult to solve
- Solving such problems involves cognitive, social, and emotional elements
- Yet, these elements often conspire to:
  - limit the search for problem formulations, which can lead to solving the wrong problem
  - limit the search for solutions, which can lead to inferior decisions
  - block out disconfirming evidence that could help you overcome these limitations
  - generate poor decision-making

Three kinds of “thinking”

- **Fast under threat** (Sympathetic Associative Thinking)
  - Automatic, based on a narrow set of categories, heuristics, and stereotypes and short-run goals of preserving the ego (responding to threat). Often maladaptive in the long-run.

- **Fast and calm** (Parasympathetic Associative Thinking)
  - Automatic, based on a broad set of categories, heuristics, and stereotypes and long-run goals. Can be adaptive but also maladaptive depending on complexity and ill-structuredness of the situation.

- **Slow and calm** (Reasoning and Executive Thinking)
  - Requires sustained attention and effort. Can be highly adaptive with long-run goals but adaptiveness can be limited based on concepts and thinking processes previously learned.
Sympathetic vs. Parasympathetic

What triggers each mode?

- Sympathetic Nervous System (SNS) vs. Parasympathetic Nervous System (PNS)
  - Perceived threat from amygdala activates the SNS, which leads to physiological changes in brain/body.
  - Increasing activation of SNS narrows associative thinking to responses to those that are more instinctual.
    - These responses are based on short-run goals adaptive to fight, freeze, or flee.
  - PNS and SNS are negatively correlated:
    - Increased activation of the PNS counteracts SNS and expands associative thinking responses.
    - Guidance under PNS can be adaptive based on long-run goals but could be maladaptive if poor learning or match.
Mailbox metaphor

▶ SNS narrows down the mail boxes easily accessible from which heuristics are then selected.
▶ Associative thinking with PNS activated accesses a broader set of mailboxes; especially those recently opened.

Reasoning/Executive trigger

▶ Conflict monitoring hypothesis
  ➢ The brain facilitates resolution of *conflicting*, *inconsistent*, or *absent* heuristic signals by focusing, allocating, and utilizing reasoning and executive cognitive resources to resolve the conflict (Botvinick, Cohen, and Carter 2004).
  
  ➢ Hence, when associative thinking delivers heuristics that are in *conflict*, *inconsistent*, or *absent* the reasoning/executive resources are called upon.
Determinants of type of thinking

- Fast under threat (Sympathetic Associative Thinking)
- Fast and calm (Parasympathetic Associative Thinking)
- Familiar
- Slow and calm (Reasoning and Executive Thinking)
- Conflicting, inconsistent, absent heuristics

Biases of fast thinking

- Fast thinking, whether SNS or PNS based, spark a specific set of biases:
  - Propensity to jump to a solution
  - Framing bias
  - Anchoring bias
  - Confirmation bias
  - Self-serving bias
  - Self-justification bias

- These biases shape outcomes of associative thinking whether SNS or PNS is activated.
Were health center leaders biased?

▶ Please assess with your partner the biases in the Health Center decision …

<table>
<thead>
<tr>
<th>Bias</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propensity to jump to solutions</td>
<td></td>
</tr>
<tr>
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<tr>
<td>Self-justification</td>
<td></td>
</tr>
</tbody>
</table>

Code with:
- None
- Some
- A lot
or 0, 1, 2

Associative thinking biases

Ego preservation biases

׳Associative thinking can stimulate ego and ego can increase resistance to challenging thinking.

What kind of thinking did you use?

▶ Let’s go back to your two situations and please discuss with your team of two:

- Was your SNS or PNS activated?
  - Where you under stress, anxiety, time pressure?
  - How much? (some, moderate, a lot?)
- Did you consider the situation routine and familiar?
- Did you initially perceive some degree of novelty or conflicting or inconsistent perspectives?
Do you have biases?

▶ Please use the table below to assess with your partner your *personal* situation …

<table>
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- **Code with:** None, Some, A lot or 0, 1, 2

**Associative thinking biases**

**Ego preservation biases**

*Associative thinking can stimulate ego and ego can increase resistance to challenging thinking.*
Triple-tier Brainstorming
(A general method)

Can formulations be comprehensive?

► Decision-makers frequently perceive threats.
  ➢ Stress, time pressure, the potential loss of resources including status and trust, etc.
     ▶ Threats need not be severe or great in magnitude.
     ▶ Threats are surprisingly common in organizations.
     ▶ Complex and ill-structured (and strategic) problems create threats.

► The amygdala frequently activates.
  ➢ SNS corrupts, perhaps severely, the ability to think strategically through fast thinking under threat.

► What can be done?
A general critical thinking method

▶ Triple-tier brainstorming…
- is a novel 6-step method for formulating and solving problems.
- offers a method by which you can increase the likelihood of formulating and solving the right problem.
- may initially feel awkward because it is different from most methods you have used before.
- may initially take some time to become accustomed to the method (try it six times).
- with repeated practice you may fundamentally transform your critical thinking ability.
- can be used with a team.

**Triple-tier Brainstorming**

- **Launch Inquiry**: Problem finding, framing, formulating
- **Divergent Thinking (Tier 1)**: Choose Problem (Tier 2) set of questions chosen to be addressed
- **Divergent Thinking (Tier 3)**
- **Convergent Thinking**
- **Decision**
- **Reflection**

Forestall thinking of or mentally committing to a decision or solution
Preparation for thinking

▶ Begin with an activity to stimulate your PNS.
  ➢ Moment of meditation and centering
  ➢ A sincere appreciation
  ➢ A reflection of a meaningful or pleasant moment
  ➢ Exercise, walking, etc.

▶ Adopt one rule: *do not discuss or even think about solutions for the first two tiers.*
  ➢ Facilitate to avoid jumping to solution
  ➢ Solutions quickly narrow formulations and, alternatives, spark conflict and activate ego

Tier I Brainstorming

▶ Brainstorm tier I: Categorical brainstorming
  ➢ Use one of two approaches to force a variety of perspectives on the challenge:
    ▶ Either undertake a “Stakeholder analysis”
      o Identify all stakeholders.
      o Formulate from each stakeholder’s perspective.
    ▶ Or “Brainstorm perspectives”
      o Brainstorm X relevant “problem categories” that represent particular sets of shared characteristics.
      o 10 < X < 20
Option 1: Stakeholder analysis

Who are (all) the relevant stakeholders?

How do they formulate the problem?

Option 2: Brainstorm perspectives

▶ Develop a list of between 10 and 20 different formulations.
  ➢ Generate more if you can.

▶ What is a formulation?
  ➢ A simple formulation takes the form of:
    ▶ How can <achieve some goal>?
  ➢ A complex formulation involves:
    ▶ Collecting symptoms and theorizing about root causes.
  ➢ We will focus on the use of simple formulations…
Health Center Tier I Brainstorming

▶ Stakeholder analysis
  ➢ Administrators
    ▶ How can we increase revenue?
    ▶ How can we respond to shortfalls?
    ▶ How can we provide better service to patients?
  ➢ Employers
    ▶ How can we keep workers healthy and working without paying for insurance?
    ▶ How can we reduce worker absences?
  ➢ Health care workers
    ▶ How can we provide more health care not sick care?
    ▶ How can we better support patients?
    ▶ How can we make our jobs easier?
  ➢ Patients
    ▶ How can we avoid getting sick?
    ▶ How can we get medical help when we can’t afford to take time off for a clinic?
    ▶ How can we afford care when sick?
  ➢ Brainstorming perspectives
    ▶ How can we better support our clientele?
    ▶ How can we better serve our clientele?
    ▶ How can we figure out what they need and we are not delivering?
    ▶ How can we financially support our organization’s sustainably?
    ▶ How can we provide a higher societal return/expenditures?
    ▶ How can we attract more clients?
    ▶ How can we serve employers who don’t provide insurance?
    ▶ How can we attract more resources from donors/funders?
    ▶ How can we better serve the community to secure resources?

Comments on Tier 1

▶ Did individual words evoke new and different understanding of the challenge?
  ➢ E.g., How can we better support our clientele?
  ➢ E.g., How can we better serve our clientele?
▶ With an expanding list did you begin to develop an increasingly nuanced perspective?
▶ During the brainstorming what happened to:
  ➢ Jumping to a solution?
  ➢ Anchoring and framing?
  ➢ Confirmation?
  ➢ Self-interest and self-justification?
Tier II Brainstorming

▶ Synthesis and selection
  - *Take a step back* and synthesize most, if not all, categories into a single more nuanced formulation.
  - Then, take a *second* and further step back and reformulate a “bigger” encompassing picture.
  - Then, take a *third* and further step back and reformulate a “bigger” encompassing picture still.
  - Choose a formulation detailed with nuances that you can solve within this broader landscape.
    - Don’t simplify, incorporate.
  - Write problem formulation in a single paragraph.

Health Center Tier II Brainstorming

▶ How can we sustainably develop new or refine existing activities to cost-effectively deliver health- and sick-care services to our target clientele, when and where they need it, in a way that lowers costs or increases our resources from patients, employers, and the community?

▶ How can we effectively organize and develop a organizational approach to search for ways to sustainably expand our services to the community?

▶ How can we find a leader who can advance our services and sustainability to the next level?
Tier III Brainstorming

- Generate solution approaches
  - With the formulation in hand, brainstorm potential solution approaches (strategies).
  - Once brainstorming is exhausted, evaluate alternatives with respect to the problem formulation.
  - Combine and revise solution approaches as needed to satisfy nuances of the formulation.
  - Revise solutions approaches to satisfy feasibility and implementability criteria.

Health Center Tier III Brainstorming

- How can we effectively organize and develop a leadership approach to search for ways to sustainably expand our services to the community?
  - Appoint a service R&D leader, reporting to the president, focused on service innovation.
  - Form an ad hoc committee, reporting to the president, focused on service innovation.
  - Create a standing committee, reporting to the president, focused on service innovation.
  - Choose any of these options reporting to the head of medicine.
Analyze alternatives and decide

▶ Reflect on biases: could any have accrued?
▶ Assess robustness of each solution approach.
  ➢ What risk exists and how can it be mitigated while still capturing the upside?
    ▶ Modify the solution accordingly
  ➢ In what ways might the situation change and which solution remains robust?
  ➢ When should the solution be implemented and what are the conditions for ending or reversing it?
▶ Make the decision

Triple-tier Brainstorming

1. Begin with an activity to stimulate PNS
2. Adopt a rule: do not discuss or even think about solutions for the first two tiers
3. Brainstorm tier I: Categorical brainstorming
   ➢ Either “Brainstorming perspectives”
   ➢ Or undertake a “Stakeholder analysis”
4. Brainstorm tier II: Synthesis and selection
5. Brainstorm tier III: Generate solution approaches
6. Analyze alternatives, reflect on mitigating risks and biases, decide
Some educational resources

(Some) Resources
Problem Formulation

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WashU Olin Business School