Strategic Thinking for Problem Solving
An Overview
Strategy Club
2/12/2015
Arnaud Chevallier
What skills and knowledge are employers looking for in new hires?

What are you doing to acquire those?
Employers want more than “just” content expertise

Content knowledge +
• Ethic
• Communication
• Teamwork
• **Problem solving**
• Social responsibility
  (Casner-Lotto & Barrington, 2006)

Increasingly, employers … indicate a need for professionals who excel in teamwork, communications, **problem identification and solutions**, and the ability to have a broad view.
  (Wendler et al., 2012)

Employers … prioritize critical thinking, communication, and **complex problem-solving skills** over a job candidate’s major field of study when hiring.
  (AAU, 2013)

• Work in a team structure
• Make decisions and **solve problems**
• Plan, organize, and prioritize work
• Communicate
  (NACE, 2014)
For our purposes, let’s define a problem as the gap between where you are and where you want to be.
Taking this definition, we all spend our entire days solving problems.
Of all problem types, let’s focus on complex, ill-defined, non-immediate (CIDNI) ones.

- **Simple**
  - Homogeneous, static, and/or independent variables
  - Goals, solution path, obstacles are clear
  - Well defined

- **Complex**
  - Diverse, dynamic, and/or interdependent variables
  - No clear path to solution
  - Ill defined

Source: Pretz et al. 2003; Woods, 2000; Frensch & Funke, 1995
To solve CIDNI problems, you need both depth and breadth of knowledge; this talk is about the latter.

Breadth of knowledge across disciplines makes you a generalist.

Depth of knowledge in a discipline makes you a specialist.

Ideal problem solver (or problem solving team) is “T shaped” = generalist + specialist.

You can become a better problem solver through a four-step approach

<table>
<thead>
<tr>
<th>WHAT</th>
<th>WHY</th>
<th>HOW</th>
<th>DO</th>
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<tbody>
<tr>
<td>1. Frame the problem</td>
<td>2. Diagnose the problem</td>
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Wednesday, February 25, 15
This starts with framing the problem you should solve

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Framing the problem requires identifying **the** key question that encompasses all the other relevant questions.

See also (Davis, Keeling, Schreier, & Williams, 2007)
You must identify the right key question
To illustrate, let’s look at a real case

A friend calls you, speaking frantically: “My dog Harry is gone! I came home a few minutes ago and Harry wasn’t there.

“I left my house at noon, and when I came back, around 4pm, he was missing. Our house has a backyard with a doggy door in between.

“That’s really strange: he hasn’t escaped in months—ever since we fixed the gate, he can’t.

“Also, I fired the housekeeper this morning for poor performance. She blamed Harry, saying he sheds too much, and she was upset. I’m sure she’s kidnapped him.

“He has no collar; how are we going to find him? Also the yard crew came today to mow the lawn.

“Anyway, you’re the master problem solver. Help!”
First, you need to identify your overall objective

**HOW** can we get Harry back?

**WHY** is Harry missing?

**HOW** do we prevent this from happening again?

1. **Identify WHY** Harry is missing
2. **Identify HOW** to get him back
3. **DO:** Get him back

**In scope**

**DO:** Get him back

**Out of scope**

**DO:** prevent this from happening again

**Time**
Also, you need to think about the logistics of your project.
Capture that information in a **WHAT card** (as in, *what* you want to do in your project)

### Project name: Find Harry the dog

<table>
<thead>
<tr>
<th>Specific goals: (what you are going to do)</th>
<th>Out of scope: (what you are not going to do)</th>
<th>Sponsor(s):</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Understand why Harry is missing (<em>why</em>)</td>
<td>Prevent him from going missing again in the future (both the <em>how</em> and the implementation)</td>
<td>John and his wife</td>
</tr>
<tr>
<td>2. Identify best way to get him back (<em>how</em>)</td>
<td>Other key stakeholders: N/A</td>
<td></td>
</tr>
<tr>
<td>3. Get him back (<em>do</em>)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Time table:

<table>
<thead>
<tr>
<th>Actions</th>
<th>Needed time</th>
<th>Cumulative time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Frame the problem (define the <strong>what</strong>)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2. Diagnose the problem (find the <strong>why</strong>)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Define the diagnostic key question and identify possible causes</td>
<td>4h</td>
<td>6h</td>
</tr>
<tr>
<td>Collect the diagnostic evidence, analyze, &amp; draw conclusions</td>
<td>6h</td>
<td>12h</td>
</tr>
<tr>
<td><strong>3. Identify solutions (find the <strong>how</strong>)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Define the solution key question and identify possible solutions</td>
<td>6h</td>
<td>18h</td>
</tr>
<tr>
<td>Collect evidence, analyze, and decide which solution(s) to implement</td>
<td>6h</td>
<td>24h</td>
</tr>
<tr>
<td><strong>4. Implement (do)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>48h</td>
<td>72h</td>
</tr>
</tbody>
</table>

### Resources:

- **Money**: Spend up to $150 for the *why*, $150 for the *how*, $300 for the *do*
- **People**: Up to 3 people dedicated full time

### Possible problems:

- Speaking with housekeeper can backfire

### Mitigation actions:

- Refrain from speaking with the housekeeper until absolutely necessary
Now that you’ve identified \textit{what} problem to solve, you need to understand \textit{why} you have it.

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Our diagnostic is driven by a question with a *why* root that enables you to uncover the root causes of the problem.

**WHAT**
1. Frame the problem

**WHY**
2. Diagnose the problem

**HOW**
3. Find solutions

**DO**
4. Implement solution

**Why** is Harry missing?
To get to the diagnosis question, you need an introductory flow: a situation and complication

**Situation:** My friend has a dog—Harry—and lives in a house. Sometimes, he leaves Harry alone at the house.

**Complication:** Today, when my friend came home after 4 hours, Harry was missing.

**Diagnostic key question:** Why is Harry missing?
Capture this information in a diagnostic definition card—i.e., a **WHY card**

<table>
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<th><strong>Situation:</strong></th>
<th>My friend has a dog—Harry—and lives in a house. Sometimes, he leaves Harry alone at the house</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Complication:</strong></td>
<td>Today, when my friend came home after being absent for 4 hours, Harry was missing</td>
</tr>
<tr>
<td><strong>Diagnostic key question:</strong></td>
<td><strong>Why</strong> is Harry, the dog, missing [from my friend’s house where he was left unattended for 4 hours]?</td>
</tr>
<tr>
<td><strong>Decision makers:</strong></td>
<td>My friend and his wife</td>
</tr>
<tr>
<td><strong>Other stakeholders:</strong></td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Goals and logistics:</strong></td>
<td>Spend up to $150 on the diagnosis, design diagnostic analysis within 6 hours, conduct diagnostic analysis within 12 hours</td>
</tr>
<tr>
<td><strong>Voluntarily left-out answers:</strong></td>
<td>Call the housekeeper to accuse her of kidnapping Harry without conducting a preliminary analysis first Consider irrational explanations such as alien abduction Consider that friend is mistaken or lying when saying that Harry is not at the House</td>
</tr>
</tbody>
</table>
Next, build a **WHY issue map**: a graphical breakdown of your problem space; issue maps have four basic rules.

1. ... consistently answer a single type of question
2. ... progress from the key question to the conclusions
3. ... have mutually exclusive and collectively exhaustive (MECE) branches
4. ... are insightful

diagnostic maps answer a *why* key question
solution maps answer a *how* key question

Issue maps...
To build a map, break your diagnosis question into parts

Why is Harry, the dog, missing?
Further map out the problem space by exploring all possibilities.

Why is Harry, the dog, missing?

- Because he is stuck somewhere
- Because someone is keeping him from leaving where he is
- Because he, alone, got stuck

- Because he is roaming freely
Force yourself to think about all possible scenarios. That will require some effort.

Why is Harry, the dog, missing?

- Because he is stuck somewhere
- Because he, alone, got stuck
- Because he is roaming freely
  - Because he is roaming in a park
  - Because he is roaming in a public place
- Because he is roaming in another public place
  - Because he is roaming in the nearby school
- Because he is roaming in another public place
  - Because he is roaming in a street
- Because the person who is keeping him does so to enable us to get him back
- Because the person who is keeping him does so to prevent us from getting him back
- Because the housekeeper is keeping him to prevent us from getting him back
- Because someone else is keeping him to prevent us from getting him back
- Because they like him so much
- Because they don't like him/us
- Because a neighbor is keeping him does so to enable us to get him back
- Because the police is keeping him does so to enable us to get him back
- Because an animal shelter is keeping him does so to enable us to get him back
- Because a pet association is keeping him does so to enable us to get him back
- Because a vet office is keeping him does so to enable us to get him back
- Because someone else is keeping him does so to enable us to get him back
- Because a kid has found Harry and wants to keep him
- Because someone else has found Harry and wants to keep him
Now that you’ve structured your diagnosis, formulate your set of diagnostic hypotheses

**Hypothesis 1:** Harry is missing because the housekeeper is holding him hostage

**Hypothesis 2:** Harry is missing because someone other than the housekeeper is holding him hostage

**Hypothesis 3:** Harry is missing because someone is keeping him to enable us to get him back

**Hypothesis 4:** Harry is missing because someone is keeping him to neither enable us to nor prevent us from getting him back

**Hypothesis 5:** Harry is missing because he is roaming or stuck (but without the active participation of anyone; i.e. no one is keeping him)
Next, prioritize your analysis, which may include discarding hypotheses that seem too unlikely.

**Hypothesis 1:** Harry is missing because the housekeeper is holding him hostage

**Hypothesis 2:** Harry is missing because someone other than the housekeeper is holding him hostage

**Hypothesis 3:** Harry is missing because someone is keeping him to enable us to get him back

**Hypothesis 4:** Harry is missing because someone is keeping him to neither enable us to nor prevent us from getting him back

**Hypothesis 5:** Harry is missing because he is roaming or stuck (but without the active participation of anyone; i.e. no-one is keeping him)

Test first because it has implications on next steps.
Discard (for now) because too unlikely.
Then, look for evidence—i.e., information that you’ll use to test your hypotheses

Inspect the location:
• Quiet residential neighborhood

Talk with friend:
• Friend was away from noon to 4pm
• Harry can go between house and yard
• Harry hasn’t escaped in months, since friend fixed the gate
• Harry has no collar
• The backyard gate was closed when friend came back
• There are no holes in or under the fence
• The backyard gate doesn’t lock
• Harry can’t jump over the fence or gate
• Friend fired housekeeper that morning because of poor performance
• Housekeeper was upset and blamed Harry for shedding
• Harry escapes whenever possible, follows scents, and ends up lost
• Whenever the lawn crew is there, Harry barks loudly enough for the crew to hear

Talk with neighbor:
• Saw a police car in front of the house at 2:20pm
• Saw Harry out on the street by himself at ~2:20pm

Talk with lawn crew supervisor:
• Crew came today between 1 & 2pm
• Crew knows Harry but didn’t see him today
You may re-organize your evidence to help you gain some understanding, perhaps in a timeline or a map of the events.
Use evidence, presuppositions, and logic to test your hypotheses

Hypothesis 1: Harry is missing because the housekeeper is holding him hostage

Reason: because...
- ... she was able to do it
- ... she was willing to do it (i.e., she had a motive)
- ... our body of evidence doesn't contradict this hypothesis

Reason: because...
- ... she had access to Harry
- ... Harry follows people—even strangers—or let them pick him up

Objection: but...
- ... Harry was not taken out of the {house/yard}
Then decide if the evidence contrary to each hypothesis is sufficient to discard it.

**Hypothesis 1: Harry is missing because the housekeeper is holding him hostage**

- Reason: because...
  - she was able to do it
- Reason: because...
  - she was willing to do it (i.e., she had a motive)
- Reason: because...
  - she had access to Harry
- Reason: because...
  - Harry follows people—even strangers—or let them pick him up
- Reason: because...
  - she blamed Harry as the reason why she didn’t do a good job and, as a result of being fired, was upset
- Reason: because...
  - when upset people blame someone (or something) as the cause of their trouble, they may react
- Reason: because...
  - one way to retaliate is to hold Harry hostage

**Decision: X**

Rationale: For this hypothesis to hold, Harry would have had first to escape and then the housekeeper would have had to see him in the street, recognize him, pick him up and take him hostage. That seems too unlikely, therefore we discard it at this time.
This will lead you to identify a subset of root cause(s) to focus on.
Now that you know why you have your problem, you can search, evaluate, and select solutions

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Start by building a solution definition card—i.e., a **HOW card**

<table>
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<tr>
<th>Situation:</th>
<th>My friend has a dog—Harry—who went missing a few hours ago</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complication:</td>
<td>While we initially suspected foul play, we now believe that no-one is preventing us from recovering Harry</td>
</tr>
<tr>
<td>Solution key question:</td>
<td><strong>How</strong> can we get Harry (the dog) back, knowing that no-one is preventing us from recovering him?</td>
</tr>
<tr>
<td>Decision makers:</td>
<td>My friend and his wife</td>
</tr>
<tr>
<td>Other stakeholders:</td>
<td>My friend’s neighbors and other people that we enlist to partake in the search</td>
</tr>
<tr>
<td>Goals and logistics:</td>
<td>Identify all solutions within 4 hours; Pick and implement subset within 12 hours; Bring Harry back within 24 hours</td>
</tr>
<tr>
<td>Voluntarily left-out answers:</td>
<td>Ask neighbors to invest significant time in locating Harry</td>
</tr>
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</table>
To identify possible solutions, develop a **HOW** map

How can we get Harry (the dog) back, knowing that no-one is preventing us from recovering him?

- By bringing him back
  - By finding him
    - By finding whom found him
  - By enabling persons who saw him to find us
  - By enabling persons to find us using announcements
  - By enabling persons to find us using other means

- By ensuring that he smells the house/us
- By ensuring that he hears the house/us
- By ensuring that he sees the house/us
Keep drilling until your map is sufficiently explicit.
Next, formulate hypotheses...

- **H1**: Driving/riding/walking around—either ourselves or having others do it—is a worthwhile effort to get Harry back.

- **H2**: Locating Harry’s chip is a worthwhile effort to get Harry back.

- **H3**: Finding whom found Harry is a worthwhile effort to get Harry back.

- **H4**: Posting announcements in the neighborhood is a worthwhile effort to get Harry back.

- **H5**: Posting virtual announcements online is a worthwhile effort to get Harry back.

- **H6**: Asking people to contact us is a worthwhile effort to get Harry back.

- **H7**: Ensuring people notice us searching is a worthwhile effort to get Harry back.

- **H8**: Enabling Harry to come back by himself is a worthwhile effort to get Harry back.
... identify attributes to evaluate the alternatives and decide which to pursue

<table>
<thead>
<tr>
<th>Individual likelihood of success</th>
<th>Timeliness</th>
<th>Quickness of success</th>
<th>Lack of setup time</th>
<th>Cost</th>
<th>Weighted score</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>30%</td>
<td>40%</td>
<td>20%</td>
<td>5%</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>H₁: Searching the neighborhood</td>
<td>50</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>90</td>
<td>84.5</td>
</tr>
<tr>
<td>H₃: Informing people likely to know about missing animals</td>
<td>100</td>
<td>100</td>
<td>80</td>
<td>100</td>
<td>100</td>
<td>96</td>
</tr>
<tr>
<td>H₄: Posting virtual announcements</td>
<td>15</td>
<td>20</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>16.5</td>
</tr>
<tr>
<td>H₅: Checking announcements</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>50</td>
<td>100</td>
<td>7.5</td>
</tr>
<tr>
<td>H₆: Enabling Harry to come back on his own</td>
<td>30</td>
<td>90</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>75</td>
</tr>
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Wednesday, February 25, 15
“All” that’s left is to implement your solution

1. Frame the problem
2. Diagnose the problem
3. Find solutions
4. Implement solution
“Here is what we need to do, and here is why...”
... and sometimes to actually manage the implementation yourself

“... so, please **do X** and I’ll **do Y**”

<table>
<thead>
<tr>
<th>Task</th>
<th>Owner</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design and print announcements</td>
<td>Me</td>
<td>5pm</td>
</tr>
<tr>
<td>Post announcements</td>
<td>All</td>
<td>8pm</td>
</tr>
<tr>
<td>Alert vet</td>
<td>John</td>
<td>4:30pm</td>
</tr>
<tr>
<td>Look up pet associations</td>
<td>Jane</td>
<td>6pm</td>
</tr>
<tr>
<td>Alert pet associations</td>
<td>John</td>
<td>8pm</td>
</tr>
</tbody>
</table>

""
Also integral to implementation is evaluating your solution and course-correcting as you progress

As sailors, follow a general strategy

... but adapt it to integrate new developments
And when you’re done, celebrate!
In summary, proactively improve your strategic thinking

• Employers want you to be a good specialist and a generalist

• So develop your strategic thinking skills
  • Take ENGI/LEAD 545
  • Read powerful-problem-solving.com
  • Read timvangelder.com
  • Email me—acd@rice.edu
American Association of Universities (2013). It take more than a major: Employer priorities for college learning and student success. [p. 4]


