Strategic Thinking in Complex Problem Solving

ARNAUD CHEVALLIER

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CHAPTER 1

AN OVERVIEW OF STRATEGIC THINKING IN COMPLEX PROBLEM SOLVING

On a Wednesday afternoon, your cell phone rings. It's your friend John, and he is frantic: "My dog, Harry, is gone! I came home a few minutes ago and Harry's not here. I left my house at noon, and when I came back, around four, he was missing. Our house has a backyard with a doggy door in between. This is really strange, because he hasn't escaped in months—ever since we fixed the gate, he can't. I think the housekeeper is holding him hostage. I fired her this morning for poor performance. She blamed Harry, saying he sheds too much. She was really upset and threatened to get back at us. 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 me find him!"

You and I solve countless problems every day, sometimes even without being aware of it. Harry is a real dog, whose disappearance provided me with an opportunity to describe some tools that are universally applicable through a concrete (and true!) case. This book will help you acquire techniques to become better at solving complex problems that you encounter in your personal and professional life, regardless of your occupation, level of education, age, or expertise.

In some cases, these ideas will not apply as well to your own situation, or you may feel that an alternative is better. For instance, one limitation of this technique is that it is time consuming, so it is ill-suited to Grint's *critical problems* that require decision-making under tight deadlines.[1] If that's the case, you may want to cut some corners (more in Chapter 9) or use a different route. This is perfectly fine, because this approach is meant to be a modular system of thinking, one that you can adapt to your needs.

This book shows how to structure your problem-solving process using a four-step approach: framing the problem (the *what*), diagnosing it (the *why*), finding solutions (the *how*), and implementing the solution (the *do*) (see Figure 1.1).

1. (Grint, 2005) [pp. 1473–1474].

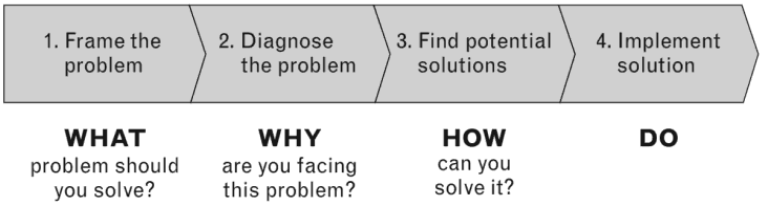

FIGURE 1.1: We use a four-step approach to solving problems.

First, identify the problem you should solve (the *what*). Facing a new, unfamiliar situation, we should first understand what the real problem is. This is a deceptively difficult task: We often think we have a good idea of what we need to do and quickly begin to look for solutions only to realize later on that we are solving the wrong problem, perhaps a peripheral one or just a symptom of the main problem. Chapter 2 shows how to avoid this trap by using a rigorous structuring process to identify various problem statements, compare them, and record our decision.

Second, identify why you are having this problem (the *why*). Knowing what the problem is, move to identify its causes. Chapter 3 explains how to identify the *diagnostic key question*—the one question, formulated with a *why* root, that encompasses all the other relevant diagnostic questions. I then show how to frame that question, and how to capture the problem in a diagnostic definition card that will guide subsequent efforts.

Next, we will do a root-cause analysis: In Chapter 4, we will diagnose the problem by first identifying *all* the possible reasons why we have the problem before focusing on the important one(s). To do that, we will build a *diagnosis issue map*: a graphical breakdown of the problem that breaks it down into its various dimensions and lays out all the possible causes exactly once. Finally, we will associate concrete hypotheses with specific parts of the map, test these hypotheses, and capture our conclusions.

Third, identify alternative ways to solve the problem (the *how*). Knowing what the problem is and why we have it, we move on to what people commonly think of when talking about problem solving: that is, actively looking for solutions. In Chapter 5, we will start by formulating a *solution key question*, this one formulated with a *how* root, and framing it. Next, we will construct a *solution issue map* and, mirroring the processes of Chapters 3 and 4, we will formulate hypotheses for specific branches of the map and test these hypotheses. This will take us to the decision-making stage: selecting the best solutions out of all the possible ones (Chapter 6).

Fourth, implement the solution (the *do*). Finally, we will implement the solution, which starts with convincing key stakeholders that our conclusions are right, so Chapter 7 provides guidelines to craft and deliver a compelling message. Then, we will discuss implementation considerations and, in particular, effectively leading teams (Chapter 8).

What, Why, How, Do. That's our process in four words.

In conclusion, Chapter 9 has some ideas for dealing with complications and offers some reflections on the overall approach.

Note that the book's primary objective is to provide a way to go through the entire problem-solving process, so it presents one tool to achieve each task and discusses that one

tool in depth, rather than presenting several alternatives in less detail.[2] Most of these tools and ideas are not mine; they come from numerous academic disciplines and practitioners that provide the conceptual underpinnings for my approach. I have referenced this material as consistently as I could so that the interested reader can review its theoretical and empirical bases. A few ideas are from my own observations, gathered over 15 years of researching these concepts, applying them in managerial settings, and teaching them to students, professionals, and executives.

1. FINDING HARRY

Let's pretend that we just received John's phone call. Many of us would rush into action relying on instinct. This can prove ineffective, however; for example, if the housekeeper is indeed holding Harry hostage, as John thinks, there is little value in searching the neighborhood. Similarly, if Harry has escaped, calling the police to tell them that the housekeeper is keeping him hostage will not help.

WHAT. So finding Harry starts with understanding the problem and summarizing it in a project definition card, or *what* card, as Figure 1.2 shows. This is the *what* part of the process. You may decide that your project is finding Harry, which you want to do in a reasonable time frame, perhaps 72 hours, and that to do so, you first need to understand why he is missing.

Project name:	Find Harry the dog		
Specific goals: (*what* you are going to do)	1. Understand why Harry is missing (*why*) 2. Identify best way to get him back (*how*) 3. Get him back (*do*)	Out of scope: (*what* you are not going to do)	Preventing him from going missing again in the future (both the how and the implementation)
Decision maker(s):	John and his wife	Other key stakeholders:	N/A

Timetable:	Actions	Needed time	Cumulative time
	1. Frame the problem (define the *what*)	2h	2h
	2. Diagnose the problem (find the *why*)		
	Define the diagnostic key question and identify possible causes	4h	6h
	Collect the diagnostic evidence, analyze, and draw conclusions	6h	12h
	3. Identify solutions (find the *how*)		
	Define the solution key question and identify potential solutions	6h	18h
	Collect evidence, analyze, and decide which solution(s) to implement	6h	24h
	4. Implement the chosen solution(s) (*do*)	48h	**72h**

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

FIGURE 1.2: A project definition card—or what card—is useful to capture your plan in writing: what you propose to do by when.

2. For the latter, see, for instance (Polya, 1945), (VanGundy, 1988).

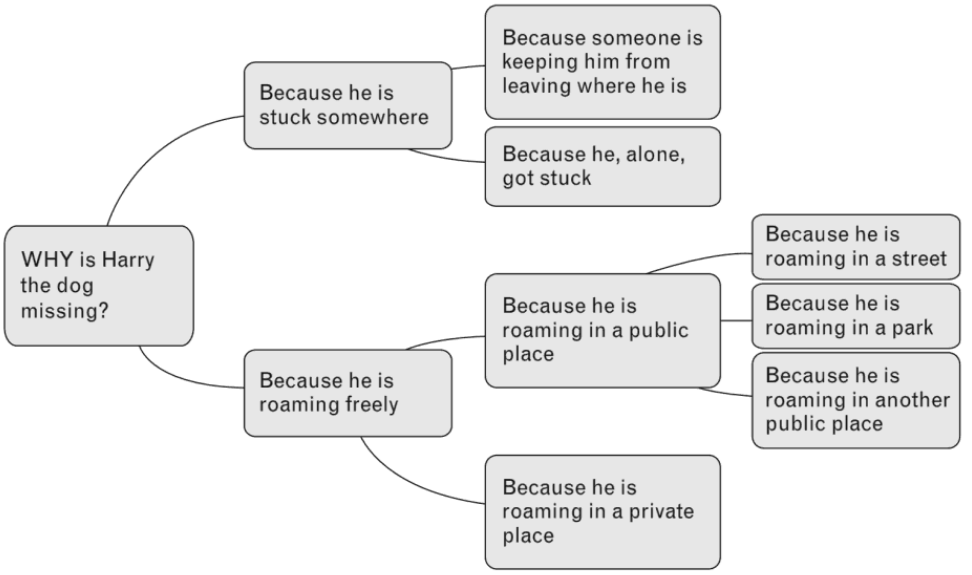

FIGURE 1.3: A diagnostic issue map helps identify and organize all the possible root causes of a problem.

WHY. Next, you will want to diagnose the problem. This is the *why* part of the process. Having identified a diagnostic key question—Why is Harry the dog missing?—you can look for all the possible explanations and organize them in a diagnostic issue map, as in Figure 1.3.

When I present this case to students, someone usually dismisses the possibility of Harry being held hostage as ridiculous. This is not as far fetched, however, as it might look: Statistics show that there is such a thing as dognapping, as it is called, and it is actually on the rise.[3] Others also question that someone would hold a dog hostage, but here, too, there is a precedent: In 1934, Harvard students dognapped Yale's bulldog mascot—Handsome Dan—and held him hostage on the eve of a Yale–Harvard football game.[4]

From here, you can formulate formal hypotheses, identify the evidence that you need to obtain to test them, conduct the analysis, and determine the root cause(s) of Harry's disappearance.

HOW. Knowing why Harry is missing, we can now identify alternative ways to get him back. This is the *how* part of the process. The procedure mirrors our diagnostic approach: We develop a solution definition card, draw an issue map (this time, a solution issue map), formulate hypotheses, identify and gather the evidence necessary to test the hypotheses, and draw conclusions.

This leads us to identify a number of possible ways to look for Harry. Because our resources are limited, we cannot implement all these solutions simultaneously; therefore, we

3. (Leach, 2013).

4. (Holley, 1997). One can only imagine the psychological damage to Yale students when they saw the next day their beloved Dan in the newspaper . . . happily eating a hamburger in front of John Harvard's statue.

TABLE 1.1: A Decision Tool Can Help Evaluate the Attractiveness of Competing Solutions

	Individual likelihood of success	Timeliness	Speed of success	Low cost	Weighted score	Ranking
Weight	0.52	0.27	0.15	0.06		
H_1: Searching the neighborhood	50	100	100	90	73	2
H_3: Informing people likely to know about missing animals	100	100	80	100	97	1
H_4: Posting virtual announcements	15	20	20	0	16	4
H_5: Checking announcements	0	0	0	100	6	5
H_6: Enabling Harry to come back on his own	30	90	100	100	61	3

must discard some or, at least, decide in which order we should implement them. To do so, we use a decision tool that considers the various attributes that we want to take into account in our decision and assign each of them a weight. Then, we evaluate the performance of each possible solution with respect to each attribute to develop a ranking, as Table 1.1 shows.

DO. Now that we have identified how we will search for Harry, the strategizing part is over, and it is time to implement our plan. The *do* part of the process starts by convincing the key decision makers and other stakeholders that we have come to the right conclusions. We then move on to agreeing on who needs to do what by when and then actually doing it. The implementation also includes monitoring the effectiveness of our approach and correcting it as needed.

The case is a real story—although I changed Harry's name, to protect his privacy—and we did find him after a few hours. This problem is relatively simple and time-constrained; therefore, it does not need the depth of analysis to which we are taking it. It provides a roadmap, however, for solving complex, ill-defined, and nonimmediate problems (CIDNI, pronounced "seed-nee"). As such, we will come back to Harry in each chapter to illustrate how the concepts apply in a concrete example.

2. SOLVING COMPLEX, ILL-DEFINED, AND NONIMMEDIATE PROBLEMS

A *problem* can be defined as a difference between a current state and a goal state.[5] *Problem solving*, the resolution of such a difference, is omnipresent in our lives in diverse forms, from

5. See, for instance (David H. Jonassen, 2000), (G. F. Smith, 1988).

executing simple tasks—say, choosing what socks to wear on a given day—to tackling complex, long-term projects, such as curing cancer. This book is about solving the latter: the complex, ill-defined, and nonimmediate problems.

Complex means that the problem's current and goal states, along with obstacles encountered along the way, are diverse, dynamic during their resolution, interdependent, and/or not transparent.[6] *Ill-defined* problems have unclear initial and final conditions and paths to the solution.[7] They usually do not have one "right" solution;[8] in fact, they may not have any solution at all.[9] They usually are one of a kind.[10] Finally, *nonimmediate* means that the solver has some time, at least a few days or weeks, to identify and implement a solution. At the organizational level, a CIDNI problem for a company may be to develop its marketing strategy. On a global scale, CIDNI problems include ensuring environmental sustainability, reducing extreme poverty and hunger, achieving universal primary education, and all the other United Nations' Millennium Development Goals.[11]

A fundamental characteristic of CIDNI problems is that, because they are ill-defined, their solutions are at least partly subjective. Indeed, appropriate solutions depend on your knowledge and values, and what may be the best solution for you may not be for someone else.[12] Another implication is that the problem-solving process is only roughly linear. Despite our best efforts to define the problem at the onset of the project, new information surfacing during the resolution may prompt us to modify that definition later on. In fact, such regression to a previous step may happen at any point along the resolution process.[13]

Think about what makes your problem CIDNI. Problems can be challenging for various reasons, and understanding these may help you choose a direction in which to look for a solution. Some problems are complex because they are computationally intensive. A chess player, for instance, cannot think of all alternatives—and all the opponent's replies—until late in the game, when the universe of possibilities is much reduced. Chess, however, is a fairly well-defined environment.

Contrast this with opening a hotel in a small village in the Caribbean and discovering that obtaining a license will require bribing local officials. The challenge here is not computational, but the problem is ill-defined in important ways: Do you still want to carry out the project if bribery is a requirement? If you want to avoid bribing officials, how can you do so successfully? And so on.

Indeed, ill definition stems in many ways when human interactions are part of the picture. Consider the case of a graduate student ready to defend her dissertation only to discover that two key members of her jury have just had a bitter argument and cannot sit in the same room for more than five minutes without fighting. How should she proceed?

6. (Wenke & Frensch, 2003) [p. 90], (Mason & Mitroff, 1981) [p. 5].

7. (Simon, 1974), (David H. Jonassen, 1997), (Pretz et al., 2003) [p. 4], (S. M. Smith & Ward, 2012) [p. 462], (Mason & Mitroff, 1981) [p. 30].

8. (Bardwell, 1991).

9. (David H. Jonassen, 2000).

10. (Brightman, 1978).

11. (United Nations).

12. (Hayes, 1989) [p. 280].

13. See Rittel's wicked problems (Rittel, 1972).

Or consider the case, during World War II, of the British Navy capturing an Enigma cryptography machine, which gave them deep insight into the operation of German submarines. This gave them a unique opportunity to reduce the risk of attacks to their convoys. However, they could not use this information in any way that would tip off the Germans that their naval codes had been broken; indeed, the Germans would then change the Enigma codes or introduce a new communication system. How then should the British best use this information?[14]

So, rather than thinking of CIDNI problems as one type of difficult situation, you may be better served to think about what makes your problem a CIDNI problem, given that doing so may indicate where you can search out solutions. If a problem is computationally complex, for example, exploring the support that computers and artificial intelligence can bring could be of great support. In a situation that has significant moral, emotional, or psychological components, however, such support is not likely to be of much help.

3. COMPLEMENTING SPECIALIZATION WITH GENERALIST SKILLS

> *It's not so much that STEM [science, technology, engineering, mathematics] graduates do not know how to solve technical problems, because, in fact, they do, but that these graduates lack the non-technical skills needed for the job.*
>
> *That's one of the points that Meghan Groome, the executive director of education and public programs at the New York Academy of Sciences, emphasized [. . .].*
>
> *"The problem is universal," Groome explained. "Students are not learning how to network, manage their time, or to work together." These skills, Groome insisted, are those that students can learn if they take the right courses.*[15]

There is widespread agreement that an ideal CIDNI problem solver (or problem-solving team) is "T-shaped," that is, both a specialist in the relevant disciplines and a generalist.[16]

Formal training programs usually focus on the discipline-specific side, the vertical bar of the "T," but they fall short on the generalist front,[17] which is problematical. For instance, a report by the National Academies notes that, because real-world problems are ill defined and knowledge intensive, they often differ considerably from the ones students solve in class.[18] This leads to some students' inability to translate what they learn on campus to practical situations,[19] what physics Nobel Prize laureate Richard Feynman called a "fragility of knowledge."[20]

14. See (Blair, 2000) [p. 298].

15. (Weiner, 2014).

16. (Perkins & Salomon, 1989), (Gauch, 2003) [pp. 2–3], (Grasso & Burkins, 2010) [pp. 1–10]; (Kulkarni & Simon, 1988) [p. 140], (Sanbonmatsu, Posavac, Kardes, & Mantel, 1998), (Sheppard, Macatangay, Colby, & Sullivan, 2009) [p. 175], (Katzenbach, 1993), (Savransky, 2002) [p. 18], (M. U. Smith, 1991) [pp. 10–15], (Brown & Wyatt, 2010).

17. (Theocharis & Psimopoulos, 1987), (Manathunga, Lant, & Mellick, 2006).

18. (National Research Council, 2012) [p. 76]. See also (Manathunga, Lant, & Mellick, 2007).

19. (Chi, Bassok, Lewis, Reimann, & Glaser, 1989), (David H. Jonassen, 2000). See also (National Research Council, 2014) [pp. 53–55].

20. (Feynman, 1997) [pp. 36–37].

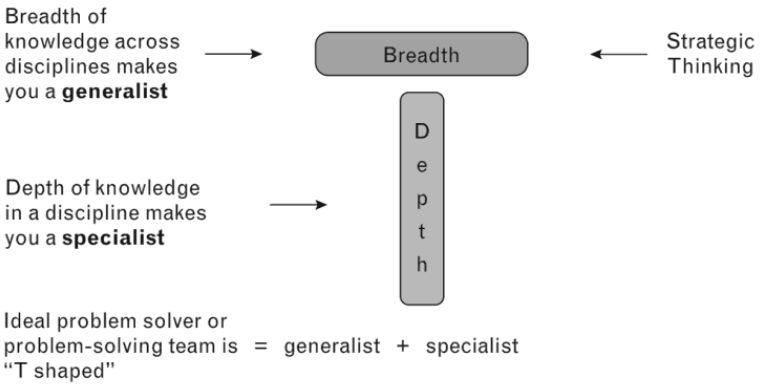

FIGURE 1.4: Effective CIDNI problem solvers are both generalists and specialists; this book helps improve generalist skills.

Another drawback of focusing solely on the vertical bar of the T is that it limits innovation as we fall prey to the "not invented here" syndrome. Yet, there is considerable value in "stealing" ideas from other disciplines. For instance, consider the use of checklists that first appeared in airplane cockpits and are now being increasingly used in operating rooms. Despite strong initial resistance by surgeons, their adoption has led to significant reductions in postsurgical complications.[21] Similarly, medical practices also are adopted by other disciplines: The rise in the 1990s of evidence-based medicine—the reliance on evidence from well-designed and conducted research to guide decision making—has helped initiate a practice of evidence-based management in the last decade.[22] In both these cases, an ability to see value in a field different than one's own was needed and paid off. Developing an ability to see past the surface features of problems to concentrate on the underlying structure, and recognizing that this may be achieved by looking at problems in other disciplines is, therefore, beneficial. As we will see in the ensuing chapters, it is also a requirement for good analogical thinking.[23]

In short, *Strategic Thinking in Complex Problem Solving* offers ways to develop that horizontal, strategic, cross-disciplinary knowledge necessary to be an effective CIDNI problem solver (see Figure 1.4).

This approach enables you to tackle any problem, even ones in which you are not a specialist, in a structured and creative way. And in today's economy, where organizations are constantly reinventing themselves, this skill makes you a very desirable asset.[24]

21. (Gawande, 2009).

22. (Rousseau, 2006), (Rousseau & McCarthy, 2007), (Rousseau, 2012), (Pfeffer & Sutton, 2006b), (Pfeffer & Sutton, 2006a).

23. See, for instance (Keith J. Holyoak & Koh, 1987), (National Research Council, 2011a) [pp. 136–138].

24. (National Association of Colleges and Employers, 2014) [p. 4].

4. FIVE KEY GUIDELINES THAT SUPPORT OUR APPROACH

Before we look in detail at the four steps of the problem-solving process, let's conclude this overview by presenting five key principles that each apply to various steps.

1. USE DIVERGENT AND CONVERGENT THINKING

Effective problem solving requires both divergent and convergent thinking patterns.[25] As Figure 1.5 shows, this occurs at each step of the process. Diverging, you think creatively: stretching your mind to identify new possibilities. Converging, you think critically: gathering data to analyze each possibility, compare it with others, and select the best. Whenever possible, you should defer judgment, that is, you should keep idea creation (or *ideation*[26]) separate from idea *evaluation*.[27] This is to avoid restricting your creativity.[28] We will address this again in Chapters 3 and 5.

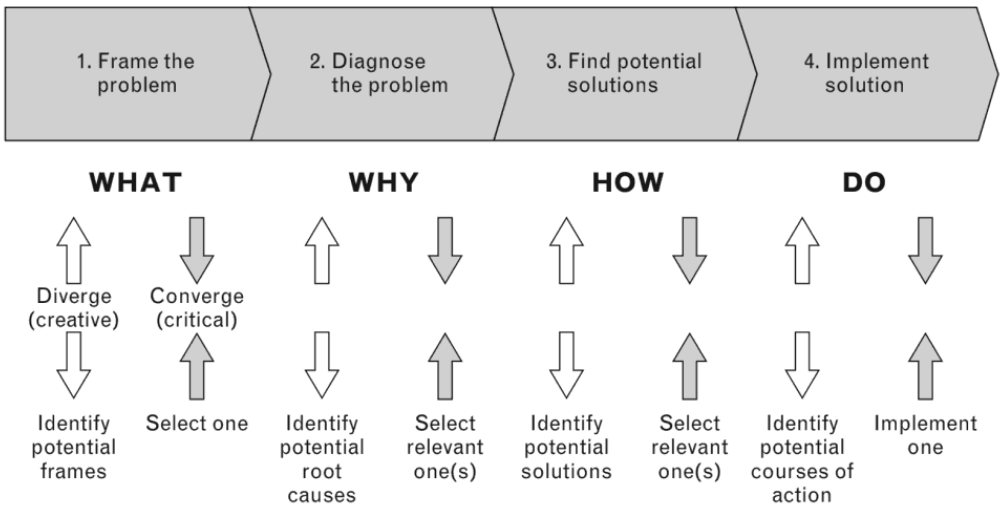

FIGURE 1.5: Effective complex problem solving requires alternating divergent and convergent thinking.

25. See, for instance (Basadur, Runco, & Vega, 2000), (Adams, 2001) [pp. 120–121], (Assink, 2006), (Basadur, Graen, & Scandura, 1986). For a review of divergent thinking in generating alternatives, see (Reiter-Palmon & Illies, 2004).

26. (S. M. Smith & Ward, 2012) [p. 465], (VanGundy, 1988) [p. 5], (Adams, 2001) [p. 121].

27. Although we prefer deferring judgment, an alternative approach allows applying some convergent thinking during idea production. See (Basadur, 1995) for a review.

28. See (Hammond, Keeney, & Raiffa, 2002) [p. 53].

2. USE ISSUE MAPS

A central tool in our methodology is the issue map, a graphical breakdown of a question that shows its various dimensions vertically and progresses into more detail horizontally. There are many types of cartographic representations of problems, including trees, diagrams, and maps. One attribute they share is that they expose the structure of the problem, thereby promoting better understanding. Graphical breakdowns of arguments, for example, have been shown to significantly improve people's critical thinking.[29] We will discuss maps extensively in Chapters 3 and 5.

Figure 1.6 shows a typical issue map. It starts with a key question on the left, in this case a solution key question, with a *how* root. It then lists and organizes solutions on the right. These solutions do not have to be desirable but, applying the principle of deferred judgment of the previous section, we refrain from evaluating them until later in the process.

Maps enable us to consider all possibilities exactly once: we do not consider a possibility more than once, and we do not leave out any. That is, maps structure the universe of answers in a set of *mutually exclusive* and *collectively exhaustive* branches (or *MECE*, pronounced "me-see").

Mutually exclusive (ME) means "no overlaps." Two events are mutually exclusive when the occurrence of one precludes the occurrence of the other. Organizing the answers to a question in mutually exclusive branches means that you consider each one only once, thereby not duplicating efforts. To think ME, you must think in a convergent pattern, determining whether branches are truly distinct.

So if you set yourself to answer the question, "How can I go from New York City to London?" and you reply by first dividing means of transportation between "flying" and "traveling by sea," you are organizing the possible solutions of your problem in a ME way, because you cannot be flying and traveling by sea at the same time.

Collectively exhaustive (CE) means "no gaps." Events are collectively exhaustive when they include all possible outcomes. So the branches of an issue map are CE when they include all the possible answers to the key question. To think CE you must think divergently,

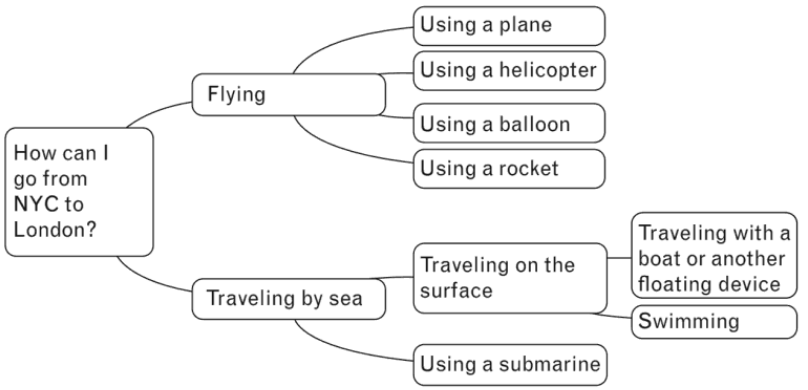

FIGURE 1.6: Issue maps graphically expose the structure of a question.

29. (Twardy, 2010).

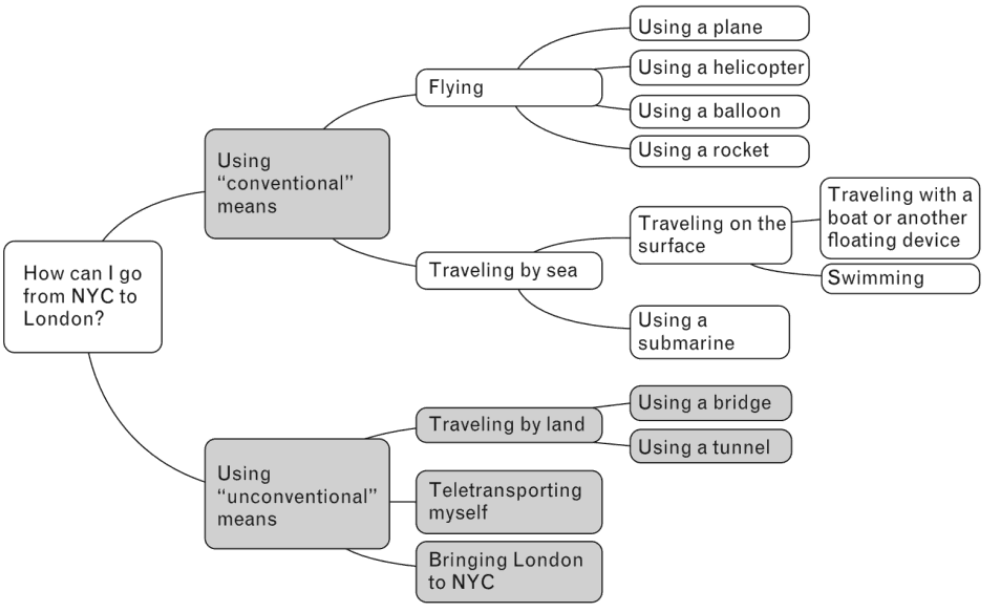

FIGURE 1.7: Part of the process is to think divergently to identify as many solutions as possible so as to leave no gaps.

asking yourself repeatedly, "*What else* could be an answer to this question?" So you must be very creative; Chapters 3 and 5 will give you ideas to do that, such as relying on analogies or existing frameworks.

When you are identifying options to go from NYC to London, CE thinking means that you are considering all possibilities. Although we initially thought that traveling by sea or air were the only possibilities, forcing ourselves to be CE results in an expanded list, as shown in Figure 1.7. The possibility of traveling by sea or air occurs quickly to people thinking about this situation, so let's stick these options into a branch that we call "conventional." Then, to be CE, we should have a "nonconventional" branch. What could this include? Well, people also travel by land. What else? Perhaps teletransport. What else? Well, maybe I should not travel to London; instead, London should travel to me. And we could go into further details there: perhaps we could have the people I was going to meet in London come to me or maybe we could create a London where I am. That sounds far-fetched. True. But, first, abiding by the principle of deferred judgment, we should not care whether it is far-fetched—not until later. And second, even if it is far-fetched, there are precedents: Las Vegas has done it with the Eiffel Tower, so why not us? Again, these new options may not be desirable. What is important is that, if we end up discarding them, we will do so because of a conscious decision, not because we forgot to consider them. We will talk more about MECE thinking in Chapters 3 and 5.

3. ACQUIRE THE RIGHT SKILLS

In 2001, the United Kingdom's Research Councils and the Arts and Humanities Research board released a joint statement highlighting the skills that doctoral students are expected

TABLE 1.2: Useful Skills in Research[a]

	You should be able to . . .
Research Techniques	Identify and solve problems Think originally, independently, and critically Critically assess your and others' findings Document, synthesize, report, and reflect on progress Apply appropriately the relevant research techniques in your field Identify and access appropriate bibliographical material and other information
Research Environment	Conduct yourself appropriately (legally, ethically, responsibly, etc.) Understand the context in which your research takes place Understand process for funding
Project Management	Set goals and intermediate milestones Prioritize activities
Personal Effectiveness	Be willing and able to acquire knowledge Be creative, innovative, and original Be self-reliant, work independently, and show initiative Be flexible and open-minded Be self-aware and identify own training needs Be self-disciplined, motivated, and thorough Recognize your boundaries and ask for help as needed
Communication	Write clearly with an appropriate style Build coherent and compelling arguments tailored to audiences Support the learning of others Contribute to the public understanding of your research field
Networking and Team Work	Develop and maintain cooperative networks Manage effectively relationships up, down, and sideways in your organization and elsewhere Understand your contribution and impact to the success of teams (formal and informal) Listen, give and receive feedback, and respond appropriately
Career Management	Partake in ongoing professional development Identify key success factors for progression in your targeted professional path Take ownership of your career progression: set challenging yet realistic goals and identify ways to improve your employability Demonstrate insight in the transferability of your skill set to other disciplines Present your profile through the use of curriculum vitae/résumés, cover letters, and interviews Strike an appropriate work–life balance

[a]After Research Councils, United Kingdom. (2001).

to develop during their research training.[30] Table 1.2 summarizes some of these skills. These are relevant to you even if you are not working on a doctorate. Indeed, solving problems requires doing research: identifying which evidence you need to gather and assessing it. We will talk about working with evidence in Chapters 4 and 6.

This book provides pathways to develop many of these skills. You may find value using this list as a roadmap for your own development.[31] Alternatively, you may elaborate your own list. But you may also face a problem before you get a chance to develop the skills; when that happens, and you should probably assume that it will, you should consider teaming up with people who have complementary skills.

Enlist others. Working with others may increase quality and visibility. It used to be that the works of lone geniuses were the most impactful, but this might be changing. Collaborative work has resulted in many contributions, including the discovery of DNA, the creation of the Linux operating system, and the development of the Internet.[32] Also, scientific papers with multiple authors are cited more than twice as frequently as those by single authors.[33]

Leverage diversity. When I teach this method in a course, it is a practical workshop. Each student brings a project that he or she is interested in and we use these as case studies. Students come from all disciplines, but they must help others and seek help from others (a large chunk of their grade depends on it) and they need to sit next to a different colleague in each session. Although this collaboration across disciplines does not come naturally to many, they quickly see its value: People with different training bring different perspectives, which helps each of them be more creative. This is in line with observations from a committee of the National Research Council: "Analysis improves when analysts with diverse perspectives and complementary expertise collaborate to work on intelligence problems."[34] We will talk extensively about the value of collaboration and diversity throughout the book.

4. SIMPLIFY TO REVEAL THE UNDERLYING STRUCTURE

Simplicity is central to numerous practices in many fields. In the scientific method, the parsimony principle recommends that, all other things being equal, the simplest theory that fits the facts should be preferred.[35] Copernicus used it to propose his model of motion of the earth (the heliocentric one, i.e., a daily revolution around its axis and an annual revolution around the sun) over the then-favored Ptolemaic one. Copernicus's model did not generate a better fit, but it was simpler.[36]

30. (Research Councils UK, 2001).

31. For other lists, see (Reeves, Denicolo, Metcalfe, & Roberts, 2012) and (Careers Research and Advisory Centre, 2010).

32. (Ness, 2012).

33. (Wuchty, Jones, & Uzzi, 2007).

34. (National Research Council, 2011a) [p. 61]. See also (National Research Council, 2014) [p. 64].

35. (Gauch, 2003) [pp. 269–270].

36. (Gauch, 2003) [p. 273].

In design, simplicity is often linked to quality and usability.[37] At Apple, Steve Jobs viewed it as the ultimate sophistication, which resulted in many Apple products *not* having the features of their competitors' and yet outselling them.[38]

Though the end product may be simple, the process to get there usually is not. Here is Steve Jobs again: "When you start looking at a problem and it seems really simple with all these simple solutions, you do not really understand the complexity of the problem. And your solutions are way too oversimplified. Then you get into the problem, and you see it's really complicated. And you come up with all these convoluted solutions . . . that's where most people stop, and the solutions tend to work for a while. But the really great person will keep on going and find . . . the key, underlying principle of the problem. And come up with a beautiful elegant solution that works."[39]

I have seen this happen multiple times. In my course, my students must reformulate their problem to make it understandable to the rest of us. This is difficult for some of them, particularly those versed in highly technical subjects, and some invariably claim that expressing their problem in simple, accessible terms is not possible. They all, however, eventually discover that it is. Moving beyond the surface features of their disciplines, they learn to focus on their problem's underlying structure, and by expressing it in simple terms, they enable others to assist them in solving it.

This challenge of simplification is worthy not just because they now have a larger and more diverse network of people to help them, but because it also forces them to clarify their understanding of their problem: having to do away with the jargon of their field, they can no longer present their problem in the terms that they have heard it expressed by specialists. They now have to answer "dumb" questions that they have been trained not to ask, which forces them to understand why (or why not!) these questions are dumb. Moving beyond surface characteristics to focus on the structure of problems is also an essential component of successful analogies,[40] so by going through this process, students learn to see similarities among disciplines.

Transcend "that's interesting": understand the "so what?" Gathering lots of data about a problem is not necessarily helpful; in fact, it can be counterproductive (see Table 1.3). So finding that something is interesting should not be an end point but, rather, a starting point to dig deeper. Analyze your thinking: If you find something interesting, why is it so? What is the "so what?" of your finding? Keep on assaulting your problem with critical thinking until you reach simplicity. We will talk more about this in Chapters 3, 4, and 5.

5. DO *NOT* FOOL YOURSELF (AND OTHERS)

In his address to the graduating class of 1974 at Caltech, Richard Feynman urged students to "not fool yourself—and you are the easiest person to fool."[41] This is in line with findings

37. (Karvonen, 2000).

38. (Thomke & Feinberg, 2009).

39. Cited in (Thomke & Feinberg, 2009).

40. (Keith J. Holyoak, 2012), (Keith J. Holyoak & Koh, 1987), (National Research Council, 2011b) [pp. 136–138].

41. (Feynman, 1998).

TABLE 1.3: Empirical Findings Contradict Conventional Wisdom Along the Problem-solving Process; The Book Addresses Some of These Differences[a]

Conventional Wisdom	Empirical Findings	Mitigation Tactics
The more information, the better.	More information is not necessarily better; in fact, it can provide unwarranted confidence and dilute the diagnosticity of other information items (Arkes & Kajdasz, 2011, p. 157).	Seek only diagnostic evidence. Ensure that sources of information are independent. See Chapters 4 and 6.
The more confident, the more likely we are to be correct.	Even experts may lack a strong relation between confidence and accuracy (Dawson et al., 1993; Arkes & Kajdasz, 2011, p. 147).	Seek feedback on your predictions, hold yourself accountable, and consider contrary evidence (Arkes & Kajdasz, 2011, pp. 149–150). See Chapter 4.
Expertise only has upsides.	Expertise comes with preconceptions that can introduce biases when considering data (Arkes & Kajdasz, 2011, p. 146) and an inability to modify old thinking (Pretz, Naples, & Sternberg, 2003, p. 15).	Use experts and novices judiciously. See Chapters 4 and 8.
Intuition is trustworthy.	Humans are heavily biased, so intuition is not necessarily trustworthy (Bazerman & Moore, 2008).	Decide quickly only if you are likely to pick the right answer, the cost of error is low, and swiftness brings high rewards (Kahneman, 2011, p. 79). See Chapters 3 and 5.
Problem solving is primarily about finding solutions.	Framing a problem and diagnosing it appropriately can be of paramount importance (Tversky & Kahneman, 1981).	Do not jump into identifying solutions before framing and diagnosing your problem appropriately. See Chapters 2 and 3.

[a] The table is adapted from (Makridakis & Gaba, 1998) and (Arkes & Kajdasz, 2011) [pp. 143–168]. For an example of how more information can result in *worse* outcomes in a medical setting, see (Welch, 2015) [pp. 84–95].

on biases: humans are biased in many ways, often without realizing it. For instance, we have a high propensity to be overconfident;[42] to think that, had we been asked, we would have predicted an event's occurrence in advance (hindsight bias);[43] or to interpret information partially (confirmation bias).[44]

Table 1.3 summarizes some common ways in which we fool ourselves, compares those to empirical findings, and proposes remedies.

Adopt an evidence-based approach. In medicine, the belief that physicians' actions should be guided by evidence dates back at least 200 years.[45] And yet, many destructive

42. (Fischhoff, 1982) [p. 432].

43. (Arkes, Wortmann, Saville, & Harkness, 1981).

44. (Klayman & Ha, 1987), (Klayman & Ha, 1989), (Nickerson, 1998).

45. (Pfeffer & Sutton, 2006b) [p. 13].

practices remain in use; in some settings, over 30% of patients are estimated to receive care that is not consistent with scientific evidence.[46]

The modern evidence-based medicine movement advocates for integrating the best external evidence available with one's expertise and the specifics of one's situation.[47] Started in the early 1990s, it has garnered considerable attention and is credited for dramatically speeding up the process of finding effective treatments instead of relying on intuition and personal experience.[48]

Some disciplines, such as management, are now trying to emulate it,[49] while others, including the intelligence community, have been strongly advised to follow the trend.[50] This book argues that you should adopt an evidence-based approach to problem solving and we will talk about how to do this across chapters.

Confidence-wise, brace yourself. Steve Jobs's earlier quote illustrates how, when we approach new problems, we sometimes feel that we instantaneously understand them and know how to solve them. This is, in part, because we bring our own preconceptions. The four-step process described in this book aims at replacing these preconceptions and the unwarranted confidence they generate with warranted confidence. Although we hope that, at the end of it, you are rightfully confident in your views, getting there will probably be tumultuous.

Going through a rigorous evidence-based analysis of your preconceived ideas, you may soon feel that you become unsure of what you know and do not know, and your overall confidence will plunge before it rises. It is important to be able to welcome these doubts, because they are an integral part of Socratic wisdom, that is, of "knowing what you know and knowing what you do not know."[51]

Replacing unwarranted confidence requires you to take the risk of reducing your confidence, at least briefly. Although this may sound demoralizing, see it as progress: You may not yet know what the right paradigm is, but at least you now know that the one you trusted was wrong.

Following this approach, this book advocates that you base your practices on sound logic and solid evidence, synthesizing reliable external information with your own expertise, and integrating that approach with the judicious use of intuition. The book presents tools to help you do so.

Respect the scientific ideal. Cambridge's fluid dynamist Michael McIntyre defines respecting the scientific ideal as attempting to keep an open mind while deploying logical thinking, putting up with nagging uncertainty, being willing to admit ignorance, avoiding prior judgments about candidate hypotheses, and remaining skeptical about any reason to favor a theory other than the cautious application of Occam's razor (see Chapter 4). It also

46. (Grol, 2001), (Heyland, Dhaliwal, Day, Jain, & Drover, 2004), (Rauen, Chulay, Bridges, Vollman, & Arbour, 2008). See also (Golec, 2009), (Sheldon et al., 2004), (Straus & Jones, 2004).

47. (Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996), (Straus, Glasziou, Richardson, & Haynes, 2011) [p. 1].

48. (National Research Council, 2011a) [p. 28].

49. See, for instance (Allen, Bryant, & Vardaman, 2010), (Pfeffer & Sutton, 2006b, 2007), (Rousseau, 2006), (Rousseau & McCarthy, 2007).

50. (National Research Council, 2011b) [pp. 95–97], (National Research Council, 2011a) [pp. 2–4; 88, 91, 92].

51. (Pfeffer & Sutton, 2006b) [pp. 52–53].

includes revising one's position when new evidence appears and taking a look from various viewpoints. An illustration of respecting the scientific ideal is being the skeptical juror in the movie "Twelve Angry Men," the one who insists on having one last look at the evidence in a murder trial when the other eleven already think that they know the truth.[52] These characteristics and a few more are all central to the approach described in this book.

5. SUMMARY: CIDNI PROBLEM SOLVING IN A NUTSHELL

Our approach to solving complex, ill-defined, and nonimmediate problems allows us to go from where we are to where we want to be, namely, to solve problems with a four-step process (What, Why, How, Do) that rests upon five key principles (see Figure 1.8).

We can visualize these key principles as a bridge with three pillars: using convergent and divergent thinking, using maps, and acquiring the right skills. In turn, these three pillars rely on two layers of foundation: simplifying and not fooling yourself.

Do not over-design your resolution process. Before we jump into the heart of the matter, I would like to stress one last point: the methodology described in the book assumes that you have the time and resources to conduct an in-depth analysis of all stages and that it is beneficial to do so. If this is not the case—for whatever reason, maybe because you do not have enough time to conduct a full-blown analysis or maybe because you already have trustworthy answers for, say, the diagnostic—you should cut some corners. We will discuss

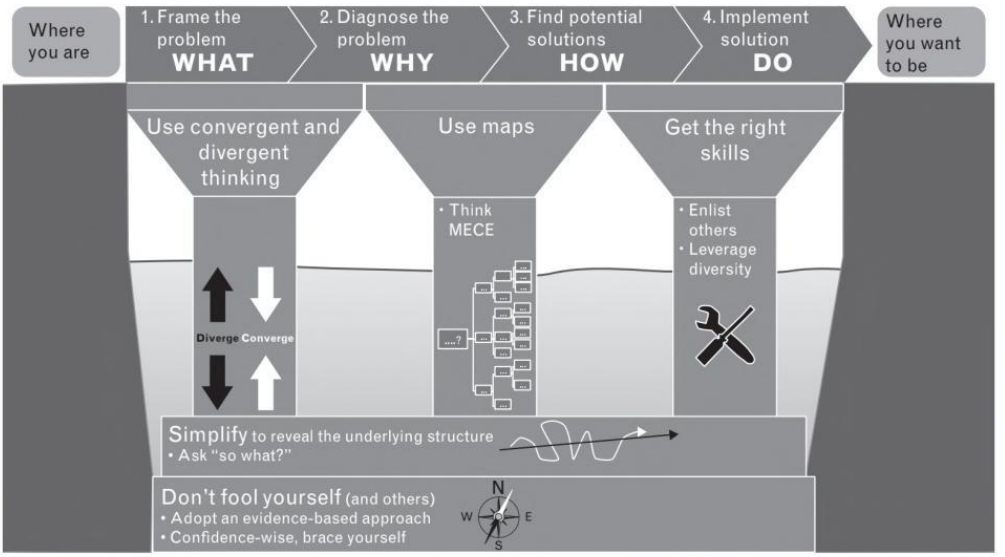

FIGURE 1.8: Five key principles support our approach to problem solving.

52. (McIntyre, 1998).

this further in Chapter 9, but you should keep this in mind as you walk your way through the resolution process.

So, if investing effort in a specific part of the resolution process seems inappropriate for your specific problem, first question this feeling, because it is easy to bypass, say, thoughtful problem framing even in situations where it is precisely what you should do. But, if after careful consideration, you think that you should fast-forward over some steps, then do so.

Having laid out a general description of our problem-solving process and an overview of each chapter, we can now move to a more detailed analysis. This starts with Chapter 2 giving some guidelines for framing the problem.

NOTES

Steps in solving problems. Our approach has four steps, but this is not universal. For instance, Basadur presents a three-step process (problem finding, problem solving, solution implementation).[53] The difference here is that we have broken the problem-finding stage into two, to separate the *what* from the *why*, in an effort to bring light to the importance of these stages. Other approaches exist: Woods identified 150 published strategies used in numerous disciplines.[54]

Treating symptoms. Peter Senge calls treating symptoms, rather than the problem itself, "shifting the burden." This may result in having the problem recur.[55]

The two dimensions of the T. Being a specialist requires domain-specific or local knowledge and skills. Being a generalist relies on knowledge and skills that are transferrable across disciplines, that is, domain independent.

From T to π. The T-shaped metaphor can extend to π-shaped or even comb-shaped skill sets where individuals have a breadth of knowledge and expertise in more than one field.[56]

Improve your "foxiness." Related to the specialist/generalist differentiation is that of hedgehogs versus foxes, a dichotomy invented by philosopher Isaiah Berlin.[57] Hedgehogs are specialized, stubborn, order-seeking, and confident. Foxes are multidisciplinary, self-critical, and cautious; they accept ambiguity and contradiction as an inherent part of life. Having compared the two groups, political scientist Philip Tetlock observes that foxes are better forecasters than hedgehogs.[58]

Strategic thinking in complex problem solving. We define strategic thinking in complex problem solving, loosely following Beaufre: Facing a problem—that is, a gap between a current and a desired positions—it is a process that includes design, analysis, and synthesis.

53. (Basadur, 1995).

54. (Woods, 2000).

55. See (Leung & Bartunek, 2012) [pp. 170–173].

56. (National Research Council, 2014) [pp. 62–63].

57. See (National Research Council, 2011b) [pp. 155–156], (Silver, 2012) [pp. 53–73].

58. (Tetlock, 2005) [pp. 20–21].

Design to identify the key activities needed to bridge the gap, analysis to assemble and process the necessary data, and synthesis to elect a solution from various alternative courses of action. In the process, strategic thinking requires rationality, intuition, and innovation.[59] Beaufre's view: Strategic thinking "is a mental process, both abstract and rational, that combines psychological and material data. The process relies on a great capacity for analysis and synthesis; analysis is necessary to assemble the data on which to make a diagnosis, synthesis is necessary to extract the diagnosis from the data. The diagnosis amounts to a choice between alternatives."[60]

Taxonomies of problems. There are many types of problems and many taxonomies to describe them. Savransky defines *routine* problems as those where all critical steps are known (a *critical step* is one that is required to reach the solution).[61] *Inventive problems* are a subset of nonroutine ones where both the solution and at least one critical step are unknown. Also, a *closed* problem is one with a finite number of correct solutions.[62]

Biases. They abound! (See Bazerman & Moore (2008, pp. 13–41) for a review.)

Using case studies. Using my students' problems as cases for the class is an example of problem-based learning, which has shown superior long-term retention and skill development. (Traditional methods, in turn, are superior for short-term retention as measured by standardized exams.)[63]

59. See also (Graetz, 2002), (Mintzberg, 1994), (Liedtka, 1998), (Heracleous, 1998).

60. (Beaufre, 1963) [p. 23].

61. (Savransky, 2002) [p.4].

62. (Savransky, 2002) [p. 5]. For more on taxonomies of problems, see also (G. F. Smith, 1988), (M. U. Smith, 1991), (Bassok & Novick, 2012), (Kotovsky, 2003). See also (David H. Jonassen, 2000) [p. 67] for a description of well-defined and ill-defined problems. For *tame, wicked,* and *critical* problems and how they relate to managers and leaders, see (Grint, 2005) [p. 1473], (Rittel, 1972).

63. (Strobel & van Barneveld, 2009), (David H. Jonassen, 2011) [pp. 153–158].

CHAPTER 2

FRAME THE PROBLEM

Researchers have discovered that when we are confronted with a new problem, it is common for us to have a mistaken impression of what the actual problem is.[1] Based on my own experience, I agree. Having coached people in hundreds of cases, I have yet to find an instance where the problem's original formulation was the one that we eventually retained. So solving effectively complex, ill-defined, nonimmediate problems (CIDNI) is first about asking good questions, or defining clearly *what* you want to do. This chapter shows how to frame the problem and capture it on a problem definition card. It goes on to cover the next step in the analysis: framing the diagnosis, which we will also capture in a card.

1. FRAME THE PROJECT

Understanding *what* the problem is and is not, and writing it down, is important because this helps clarify your project and build a shared understanding across the team.[2] This can prove to be more difficult, however, than it might appear at first. To help you out, you may want to use a template for the problem definition card—or the *what* card—such as the one shown in Figure 2.1.[3]

To illustrate, take Harry's case. Harry has just gone missing. What is our problem? Get him back? Understand why he went missing? Ensure that he does not go missing again in the future? Something else? Many people would agree that getting him back is what matters, at least for now. Fine, but how we go about finding him depends in large part on why

1. (von Winterfeldt & Edwards, 1986) [p. 31], (Rozenblit & Keil, 2002). For corroboration of the importance of problem definition, see also (L. L. Thompson, 2012) [p. 186], (Markman, Wood, Linsey, Murphy, & Laux, 2009) [pp. 94–95], and (Kaplan, 2011) [pp. 39–40].

2. Note that, in our approach, we use "problem" and "project" interchangeably, same with "goals" and "objectives." Highly complex projects—say, designing and implementing a regional highway system—may call for more details in the project plan and may require us to differentiate these terms, although I have not found a consistent taxonomy. See (Eisner, 2002) [pp. 67–90] or (Kerzner, 2003) [pp. 377–448] for more.

3. For an alternative template, see (Davis, Keeling, Schreier, & Williams, 2007).

Project name:			
Specific goals: (*what* you are going to do)	Your main objectives	Out of scope: (*what* you are *not* going to do)	Things that could be included in the project but that you have decided to leave out
Decision maker(s):	Person(s) with the formal authority to decide the direction of the project, including killing it	Other key stakeholders:	Persons who do not have formal authority but can influence the scope and outcome of the project or will be impacted by it

Timetable:	Actions	Needed time	Cumulative time
	1. Frame the problem (define the *what*)		
	2. Diagnose the problem (find the *why*)		
	Define the diagnostic key question and identify possible causes		
	Collect the diagnostic evidence, analyze, and draw conclusions		
	3. Identify solutions (find the how)		
	Define the solution key question and identify possible solutions		
	Collect evidence, analyze, and decide which solution(s) to implement		
	4. Implement (*do*)		

Resources:	Resources (money, people, equipment, etc.) that you can dedicate to the project and for how long

Possible problems:	Things that can go wrong	Mitigation actions:	Initiatives to proactively defuse the possible problems

FIGURE 2.1: A problem definition card—or *what* card—summarizes vital information about the problem.

he went missing in the first place, so it seems logical to include this in our project. And what about preventing him from going missing again in the future? Should that be included, too?

1.1. ANSWERING QUESTIONS IS NOT ENOUGH; YOU MUST IDENTIFY THEM, TOO

As we discussed in the first chapter, becoming better at solving well-defined problems is not sufficient to enable you to solve ill-defined ones, because the latter requires additional skills,[4] such as framing the problem.

Just like the frame of a painting creates a clear boundary between what is part of the painting and what is not, problems must also be clearly framed. *Problem framing*, then, amounts to defining *what* problem you are proposing to solve (and including it in the *what* card of Figure 2.1). This is a critical activity because the frame you choose strongly influences your understanding of the problem, thereby conditioning your approach to solving it. For an illustration, consider Thibodeau and Boroditsky's series of experiments in which they asked people for ways to reduce crime in a community. They found that the respondents' suggestions changed significantly depending on whether the metaphor used to describe crime was as a virus or as a beast. People presented with a metaphor comparing crime to a virus invading their city emphasized prevention and addressing the root causes of the problem,

4. See, for instance (Pretz, Naples, & Sternberg, 2003) [p. 9], (Singer, Nielsen, & Schweingruber, 2012) [p. 76], (Jonassen, 2000), (DeHaan, 2011).

such as eradicating poverty and improving education. On the other hand, people presented with the beast metaphor focused on remediations: increasing the size of the police force and prisons.[5]

Therefore, improving our ability to frame a problem may help us identify better solutions.[6] In some situations, when we are already familiar with the problem, this may require us to resist conditioning, our own or someone else's.

Resist conditioning. Consider the anecdote about the routinization of monkeys: Put five monkeys in a cage, hang a banana from the ceiling and place a ladder underneath. Soon a monkey climbs the ladder to grab the banana. As soon as he touches the ladder, spray all the *others* with cold water.

Repeat the operation when a second monkey tries to climb the ladder and, indeed, until they all learn the consequence of going after the banana. Soon, they will stop one another from climbing the ladder. Next, put the water away and replace one of the original five monkeys. The new monkey sees the banana and tries to climb the ladder. However, the other four, knowing the consequences, attack him. The new monkey has not experienced any of the water, but he has learned that he should not climb. Then, substitute another of the original monkeys with a newcomer. The new fellow sees the banana, tries to reach it but the other four—including the one that has not seen any water—beat him up, so he soon gives up. Repeat the operation until you have removed all the original monkeys. Introduce a new fellow and watch: even though none of the new monkeys have seen any water, they will all happily "explain" to the newcomer that he should not try to get the banana. Consequently, the new monkeys now all live under a banana, but none of them attempts to retrieve it. Why? As far as they are concerned, for no other reason than because it is how it has always been done around here.[7]

Conditioning is omnipresent in our lives. Consider combating the obesity crisis in North America. The traditional approach has been for physicians to stress the importance of diet and exercise. That works, but only momentarily as people easily slip back into old habits.[8] However, resisting the conditioning of focusing on these solutions may yield better results: observing that excise taxation helped reduce tobacco and alcohol consumption, public policy expert Kelly Brownell and others are proposing that we consider taxing sugared drinks.[9]

There may have been good reasons to think about a particular problem one way or another in the past, but this does not mean that these reasons are still valid. Part of the value of our methodology is to help you think about new ways to approach a problem. This requires hard work, because these new ways, by definition, will not come naturally to you. So, do not stay in your comfort zones, and certainly do not stick with the

5. (Thibodeau & Boroditsky, 2011). This is in line with studies by Kahneman and Tversky who obtained systematic reversals of people's preferred solutions to a problem by framing it in different ways (Tversky & Kahneman, 1981). These framing effects have been observed in many settings; see (Levin, Schneider, & Gaeth, 1998) for a review.

6. (Bardwell, 1991).

7. After (Scapens, 2006).

8. (Ness, 2012a) [p. 21].

9. (Brownell et al., 2009). See also (Institute of Medicine, 2014) [pp. 13–14].

TABLE 2.1: We Think Using One of Two Systems[a]

System 1—Intuitive	System 2—Reflective
Unconscious, preconscious	Conscious
Rapid	Slow
Automatic	Controlled
Low effort	High effort
High capacity	Low capacity
Associative	Rule based
Intuitive	Deliberative
Contextualized	Abstract

[a]After (Evans, 2012) [p. 116]. See also (Kahneman, Lovallo, & Sibony, 2011) for a friendly introduction of how the two thinking systems impact decision making.

we'll-ask-this because-this-is-what-we've-always-asked approach. To overcome habituation, epidemiologist Roberta Ness recommends that we become better observers; in particular, attend to details and question assumptions, so that we learn to see things in a different way than what we expect.[10]

In other situations, particularly when we are first exposed to a new problem, we may generate an opinion on the spot. Judicious framing in this case requires letting go of your intuition and instead switching to deeper thinking.

Engage System 2 thinking. A theory in psychology states that we think using one of two processes: System 1 thinking is intuitive: fast, emotional, automatic, and effortless. System 2 is reflective: slower, effortful, and more analytic (see Table 2.1).[11] Facing a problem, both our systems engage, but System 1 yields an answer faster.[12] Nobel Prize laureate Kahneman suggests that jumping to conclusions, that is, using System 1 thinking or intuition, is appropriate if one is likely to pick the right answer, the cost of an occasional error is low, and deciding quickly brings high rewards.[13] That is, System 1 is good in situations where "(1) the environment is predictable (so what happened previously is a good predictor of what will be likely to happen again); and (2) the person has had the 'opportunity to learn the regularities of the environment' through repeated exposure and feedback."[14]

When solving a CIDNI problem, it is likely that you will not meet with at least one of these conditions. Therefore, in general you should not trust your intuition but, rather, use System 2 thinking.[15]

10. (Ness, 2012b).

11. (Evans, 2012; Glöckner & Witteman, 2010; Kahneman, 2003, 2011; Kahneman & Frederick, 2002; Stanovich & West, 2000).

12. (National Research Council, 2011) [p. 123].

13. (Kahneman, 2011) [p. 79].

14. (National Research Council, 2011) [p. 122]. See also (Kahneman & Klein, 2009).

15. See (Gawande, 2009) [pp. 162–170] for a description of how successful investors attribute their success to resisting the urge to act based on System 1 thinking. Also, scuba divers are trained to pause before acting: "Stop – Breathe – Think – Act" (PADI, 2009).

1.2. CONSIDER VARIOUS ALTERNATIVES

So, if you should not trust your experience and intuition, how should you define what your problem is? In short, you should generate a pool of options to choose from and gain some perspective to help you select a good one.

Defer judgment. To improve creativity, it is usually a good idea to decouple idea generation from idea evaluation.[16] Indeed, given that having high-quality ideas usually requires first having lots of ideas,[17] you should start by generating potential candidates without judging them.

Enlist others. As you consider potential candidates for your frame, enlisting the assistance of others may help increase your creativity.[18] In fact, consider enlisting people who know little about the problem and its context, because they can ask the "dumb" questions that experts have been trained not to ask. Although asking "dumb" questions may make us appear naive to experts, naivety can be an asset because it allows us to reconsider possibilities that specialists reject.[19]

If you are the reviewer for a problem, you should ask the solvers to explain why they chose one frame over another, and why they included specific aspects and rejected others. Keep probing (it's easy, keep asking *why*). Do not be fooled by their confidence: In an evidence-based setting, statements such as, "I've been in this business; I know what I'm talking about" call for deeper investigation. As Cambridge's criminologist Lawrence Sherman puts it, "evidence-based thinking asks only 'what is the evidence?' and not 'who says so?'."[20]

1.3. DESCRIBE THE PROJECT IN A *WHAT* CARD

The idea behind using a *what* card such as that shown in Figure 2.1 is to crystalize our understanding of the problem. This is valuable because it helps us build a shared understanding of what the project is—with both external audiences (decision maker(s) and other key stakeholders) and within our own team.[21] This will help reduce the likelihood of *scope creep*, the gradual expansion of an unfolding project outside of its original objectives. Also, the *what* card serves as a roadmap for future reference, which enables us to periodically step back and validate that we are on target (time-, budget-, and quality-wise).

Going back to Figure 2.1, write the name of your project at the top of the card. On the second row, specify what the project is and what it is not. In Harry's case, once we generate various candidates for our goals and discuss with our friend John, we realize that we should first identify why Harry is missing before identifying how to get him back and actually getting him back (Figure 2.2). It would be perfectly acceptable to include actions for

16. See, for instance (Hammond, Keeney, & Raiffa, 2002) [p. 53].

17. (L. Thompson, 2003), (Adams, 2001) [p. 121].

18. (L. Thompson, 2003).

19. See (Berger, 2010) [pp. 21–28] for how designers leverage their relative ignorance to achieve breakthrough results.

20. (Sherman, 2002) [p. 221].

21. (Eisner, 2002) [pp. 67–68].

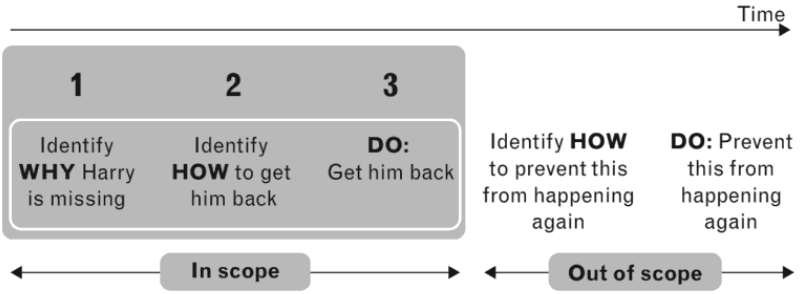

FIGURE 2.2: In Harry's case, we define the project as identifying why he is missing, identifying how to get him back, and getting him back.

preventing his disappearance from reoccurring in the future, but it may be premature to do so at this time, when such concerns are outside the scope of the project.

Explicitly including an out-of-scope section helps remove ambiguities: Each of us approaches a project with our own preconceptions and writing down what the project is and is not can be helpful in building shared understanding. This is critical: A 2011 report by the National Research Council found that many poorly performing teams do not validate that all members agree on the objectives and how to reach them.[22]

The next row in the *what* card is about people. *Decision makers* are people who can formally authorize, steer, or kill your project. Typically these are our bosses and/or clients. *Other key stakeholders* are people who do not have formal authority but have influence on the project or are impacted by it. Managing all key stakeholders appropriately—such as involving them in the project—may have a significant impact on the project's success. For example, if one is a hospital administrator whose project is to change the behavior of surgical staff to promote greater cleanliness in operating rooms, surgical staff would be key stakeholders. Indeed, engaging them in the effort from the beginning, so that they influence the project and feel ownership over the outcomes, may significantly improve the chances of success.[23] In Harry's case, the decision-makers are John and his wife and there are no other key stakeholders (see Figure 2.3).

Next is the timetable, showing the main phases in the process and the time we plan to devote to each. To simplify thinking through the project, the table is prepopulated with four steps (*what, why, how, do*), but you may decide to articulate your project around other milestones.

The next row lists the resources that you are ready to commit to the project. These can be money, people, equipment, and so on.

The final row lists possible problems, along with actions that you can take to mitigate them. The idea is to help you think from the very beginning about possible obstacles that could complicate your project and how you can proactively avoid them or reduce their impact. In Harry's case, for example, calling the housekeeper to confront her and find out if she is holding Harry hostage could be a way to make progress quickly, but it could also easily backfire: If she did not take him and is as unstable as John says she is, we might end

22. (National Research Council, 2011) [p. 177].

23. See (Ramanujam & Rousseau, 2006) [p. 823] for a discussion on the positive impact of involving people and pushing decisions down an organization's hierarchy.

Project name:	Find Harry the dog		
Specific goals: (*what* you are going to do)	1. Understand why Harry is missing (*why*) 2. Identify best way to get him back (*how*) 3. Get him back (*do*)	Out of scope: (*what* you are not going to do)	Preventing him from going missing again in the future (both the how and the implementation)
Decision maker(s):	John and his wife	Other key stakeholders:	N/A

Timetable:	Actions	Needed time	Cumulative time
	1. Frame the problem (define the *what*)	2h	2h
	2. Diagnose the problem (find the *why*)		
	Define the diagnostic key question and identify possible causes	4h	6h
	Collect the diagnostic evidence, analyze, and draw conclusions	6h	12h
	3. Identify solutions (find the *how*)		
	Define the solution key question and identify potential solutions	6h	18h
	Collect evidence, analyze, and decide which solution(s) to implement	6h	24h
	4. Implement the chosen solution(s) (*do*)	48h	**72h**

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

Possible problems:	Speaking with housekeeper can backfire	Mitigation actions:	Refrain from speaking with the housekeeper until absolutely necessary

FIGURE 2.3: Harry's *what* card summarizes key information for the project.

up having to divert significant resources to manage her. So we choose to avoid this liability altogether by refraining from speaking with her until later.

Framing the problem can be challenging and may require several iterations. Consider using the *what* card to guide your conversations with your project's decision maker(s) and other key stakeholders so as to converge toward a shared understanding of the project.

One final word about scope creep: Although the gradual expansion of a project outside of its original objectives is not desirable in many instances, in some situations, as your project progresses, you may discover evidence that warrants changing the scope. As long as any changes in scope are the result of conscious decisions taken while considering deadlines and resource restrictions, they are perfectly acceptable. To ensure that a shared understanding of the project remains, however, these changes should be reflected in the *what* card.

2. FRAMING THE DIAGNOSTIC

"There was once a village along a river. The people who lived there were very kind. These residents, according to parable, began noticing increasing numbers of drowning people caught in the river's swift current. And so they went to work devising ever more elaborate technologies to resuscitate them. So preoccupied were these heroic villagers with rescue and treatment that they never thought to look upstream to see who was pushing the victims in."[24]

24. (Steingraber, 2010).