

INTELLIGENCE ANALYSIS AS DISCOVERY OF EVIDENCE, HYPOTHESES, AND ARGUMENTS: CONNECTING THE DOTS

This unique book on intelligence analysis covers several vital but often overlooked topics. It teaches the evidential and inferential issues involved in “connecting the dots” to draw defensible and persuasive conclusions from masses of evidence: from observations we make, or questions we ask, we generate alternative hypotheses as explanations or answers; we make use of our hypotheses to generate new lines of inquiry and discover new evidence; and we test the hypotheses with the discovered evidence.

To facilitate understanding of these issues and enable the performance of complex analyses, the book introduces an intelligent analytical tool, called Disciple-CD. Readers will practice with Disciple-CD and learn how to formulate hypotheses; develop arguments that reduce complex hypotheses to simpler ones; collect evidence to evaluate the simplest hypotheses; and assess the relevance and the believability of evidence, which combine in complex ways to determine its inferential force and the probabilities of the hypotheses.

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Intelligence Analysis as Discovery of Evidence, Hypotheses, and Arguments

Connecting the Dots

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Preface

BOOK PURPOSE

This textbook has been written for those studying the process of drawing conclusions from masses of evidence resulting from extensive investigations in a variety of contexts, including intelligence analysis, cybersecurity, criminal investigations, and military and business inferences and decisions. Many universities now offer undergraduate and graduate courses concerning these activities. These courses are offered in order to provide introductory preparation for persons contemplating future work in these contexts. These courses have also been of interest to persons having various levels of past experience in these activities, but who are seeking additional knowledge concerning matters their current work requires.

As you see, our book's subtitle is a frequently used metaphor: *Connecting the Dots*. This metaphor seems appropriate in characterizing the evidential and inferential matters discussed in our book. The metaphor may have gained its current popularity following the terrorist attacks in New York City and Washington, D.C., on September 11, 2001. It was frequently said that the intelligence services did not connect the dots appropriately in order to have possibly prevented the catastrophes that occurred. Since then, we have seen and heard this metaphor applied in the news media to inferences in a very wide array of contexts in addition to the aforementioned intelligence, legal, military, and business contexts. For example, we have seen it applied to allegedly faulty medical diagnoses; to allegedly faulty conclusions in historical studies; to allegedly faulty or unpopular governmental decisions; and in discussions involving the conclusions reached by competing politicians. What is also true is that the commentators on television and radio, or the sources of written accounts of inferential failures, never tell us what they mean by the phrase "connecting the dots." A natural explanation is that they have never even considered what this phrase means and what it might involve.

Our major objective in this book is to provide accurate, useful, and extensive information about the evidential and inferential issues encountered by persons whose tasks require them to "connect the dots" to draw conclusions from masses of different kinds of evidence that come from a variety of different sources. Our book covers several absolutely vital topics that are either slighted or overlooked completely in other works concerning these tasks.

As you will see from this textbook, we have made a detailed study of what “connecting the dots” entails. We have found this metaphor very useful, and quite intuitive, in illustrating the extraordinary complexity of the evidential and inferential reasoning required to draw *defensible and persuasive conclusions* from *masses of evidence* of all kinds from a variety of different sources. The conclusions drawn in these contexts, as well as in many others, must rest on arguments that are *defensible* and *persuasive*. As we all know from experience, not all defensible arguments are persuasive and not all persuasive arguments are defensible. These conclusions, which rest on evidence, are necessarily probabilistic in nature because our evidence is always *incomplete* (we can look for more, if we have time), usually *inconclusive* (it is consistent with the truth of more than one hypothesis or possible explanation), frequently *ambiguous* (we cannot always determine exactly what the evidence is telling us), commonly *dissonant* (some of it favors one hypothesis or possible explanation but other evidence favors other hypotheses), and with various degrees of *believability* shy of perfection.

Thus one thing necessary in the study of argument construction is substantial information concerning the evidential foundations of arguments. Careful study of these evidential foundations requires consideration of the properties, uses, discovery, and marshaling of evidence. Our book covers these foundations in detail and presents a scientific approach to “connecting the dots,” where imaginative and critical reasoning are used to establish and defend the three major credentials of evidence: its *relevance*, *believability or credibility*, and *inferential force or weight*. This distinguishes our work from the many other works on the related topic of *critical reasoning* in which these foundations are either slighted or ignored.

But training in the evidential reasoning tasks required to “connect the dots” cannot be learned effectively just by listening to someone discuss his or her own analyses or just by giving students lectures and assigned readings on the topics. What is absolutely necessary is *regular practice involving analyses of evidence* using either hypothetical situations or examples drawn from actual situations. In short, evidential analysis is mastered best by performing analysis contrived to illustrate the wide variety of subtleties or complexities so often encountered in actual evidential analysis. Moreover, complex analysis cannot easily be performed by hand, but requires the use of advanced analytic tools. Thus this book also introduces an intelligent analytic tool, called Disciple-CD (Disciple cognitive assistant for Connecting the Dots).

Disciple-CD is a knowledge-based software system that incorporates a significant amount of knowledge about evidence and its properties, uses, and discovery to help you acquire the knowledge, skills, and abilities involved in discovering and processing of evidence and in drawing defensible and persuasive conclusions from it, by employing an effective learning-by-doing approach. You will practice and learn how to link evidence to hypotheses through abductive, deductive, and inductive reasoning that establish the basic credentials of evidence: its relevance, believability or credibility, and inferential force or weight. You will experiment with “what-if” scenarios and study the influence of various assumptions on the final result of analysis. So, your learning experience will be a joint venture involving this book together with your interaction with Disciple-CD.

You will have access to the Disciple-CD system as you read this book. As you will see in the following chapters of this book, a variety of vital information about evidential reasoning in intelligence analysis is presented. As we present this information, you will be asked to use Disciple-CD at various points to study and construct specific examples of matters and procedures described in the book. Here you encounter the reasoning and tutoring capabilities of Disciple-CD. This system is truly a “smart” system since it has itself already “learned” many of the evidential and inferential elements required in complex intelligence analysis. This allows Disciple-CD to be a valuable tutor since it knows what questions to ask you, and that you should answer, as you confront the various problems you and Disciple-CD will address. Therefore, Disciple-CD will be a most valuable guide along the route to your “hands-on” learning experience concerning some truly complex matters encountered in intelligence analysis.

To support further the learning by doing of intelligence analysis, each chapter contains a list of review questions. Answers to these questions are provided to the instructors using the book in their courses.

This textbook is written in a style congenial to the interests of student analysts regardless of their prior background and training. It will teach you basic knowledge about the properties, uses, discovery, and marshaling of evidence to show you what is involved in assessing the relevance, believability, and inferential force credentials of evidence. It includes a wide array of examples of the use of the Disciple-CD system and hands-on exercises involving both real and hypothetical cases chosen to help you recognize and evaluate many of the complex elements of the analyses you are learning to perform.

BOOK CONTENTS

Here is a route or map we will follow in the learning venture you will have with the assistance of Disciple-CD. Chapter 1 is introductory in nature and includes discussion of the problems we all face in forming defensible and persuasive conclusions about events in a nonstationary world that keeps changing all the while we are trying to understand events that we have observed. In the process, we will also provide an account of the process of “connecting the dots” and what this process actually entails. As you well know, critics of our intelligence services abound in the media. A very frequent charge made by these critics is that intelligence analysts are deficient in the task of connecting the dots. A major problem is that these critics have almost no awareness themselves of what is actually involved in connecting the dots. When examined carefully, the task of connecting dots is astonishingly difficult, even under the best of conditions. Careful study of the topics included in this joint learning venture involving Disciple-CD should, among other things, assist intelligence analysts to respond more effectively to their critics.

Chapter 2 addresses one of the most difficult phases in “connecting the dots”: Marshaling thoughts and evidence for imaginative analysis. It presents seven heuristics that take the form of conceptual magnets that attract interesting and useful combinations of details or *trifles*, as Sherlock Holmes

called them. Taken together, these trifles may allow us to generate a new possibility or hypothesis, ask a new and important question, or generate some new potential evidence. If you need only a general understanding of the material presented in this book, you may limit yourself to Chapters 1 and 2. If you are also interested in understanding how an intelligent analytic tool may help you with hypotheses analyses, you should also read Chapter 3, which presents an overview of Disciple-CD and some of its basic operations.

The rest of the chapters are for the readers who are interested in a deeper understanding of the theory and practice of intelligence analysis. At the beginning of each of the following chapters, we will present basic information about some important matters. Then we will ask you to make use of Disciple-CD to observe, by way of examples, how this system can incorporate these matters. In some cases, you will be asked to provide Disciple-CD with information required to solve an analytic problem. Disciple-CD will assist you in this process since it will know generally the kinds of information that are required. The instruction in the use of Disciple-CD is structured in two parts, the first containing basic operations, and the second advanced operations. You may skip the second part altogether or return to it after finishing the rest of the book. This is the “hands-on” capability of the approach we are taking to help you learn more about the complexities of evidential reasoning.

Chapter 4 contains basic information about evidence, and its three basic properties or credentials: *relevance*, *believability* or *credibility*, and *inferential force* or *weight*. These credentials are not inherent properties of evidence – analysts must establish them through defensible and persuasive arguments. The development of these arguments is discussed in Chapter 5. It involves an approach that can be termed *divide and conquer*, or *task decomposition*, in which we break some complex hypothesis into simpler elements and then reassemble these elements in forming a final conclusion.

Chapter 6 discusses various types of evidence. It also presents an automatic approach of evaluating the believability of evidence by considering lower-level believability credentials that depend on the type of evidence, such as competence and credibility, or veracity, objectivity, and observational sensitivity, in the case of testimonial evidence. This is followed, in Chapter 7, with a discussion of the believability of evidence that went through a chain of custody, where different intermediary persons or devices may have altered what an original source provided. Chapter 7 may also be skipped during a first reading of the book.

Chapter 8 discusses the recurrent combination of evidence: harmonious, dissonant, and redundant. Then Chapter 9 discusses the five major sources of uncertainty in masses of evidence: incompleteness, inconclusiveness, ambiguity, dissonance, and imperfect believability. This prepares the discussion, in Chapter 10, of four uncertainty methods that are used to assess and report the uncertainty. This is necessary because each such method captures some important elements of probabilistic reasoning, but no single method captures all of them.

Chapter 11 discusses different biases that have been identified in intelligence analysis and how Disciple-CD can help recognize and partially

counter them. They include analysts' biases in the evaluation of evidence, in the perception of cause and effect, in the estimation of probabilities, and in the retrospective evaluation of intelligence reports. This chapter also introduces three other types of bias that are rarely discussed: biases of the sources of testimonial evidence, biases in the chain of custody of evidence, and biases of the consumers of intelligence, which can also be recognized and countered with Disciple-CD.

Finally, Chapter 12 addresses the learning and reuse of analytic expertise. Disciple-CD is a very general cognitive assistant for an end-user analyst who has no knowledge engineering experience and no access to or support from a knowledge engineer. If, however, an organization can (occasionally) provide some knowledge engineering support to its analysts, then it can use Disciple-EBR, which can acquire deeper expertise from its expert analysts. Such a trained Disciple-EBR system will both reduce the analysis time and improve its quality by reusing the learned analytic expertise. The use of Disciple-EBR is presented in a complementary book, *Knowledge Engineering: Building Cognitive Assistants for Evidence-Based Reasoning* (Tecuci et al., 2016).

The book also includes a glossary of terms and several appendixes that summarize important aspects from the previous chapters (the list of methodological guidelines, the list of the hands-on exercises, and the list of the operations of Disciple-CD).

HOW TO USE THE BOOK

As already indicated in the previous section, we have structured this book to be used by a wide variety of users with different prior backgrounds, training, and interests. This allows the book to be used either as the main textbook for an entire course in intelligence analysis or as a textbook for a part of the course. In the following, we summarize several possible uses, based on the desired coverage of intelligence analysis topics (general introduction, basic topics, comprehensive discussion) and the desired level of use of Disciple-CD (no use, demonstration of use, use of basic operations, use of all operations).

General Introduction to Intelligence Analysis (without Disciple-CD)

Chapters 1, 2

Intelligence Analysis (without Disciple-CD)

Chapters 1, 2, Sections 4.1–4.3, 4.6, 5.1–5.6, 5.10, 6.1–6.8, 6.10

Advanced Intelligence Analysis (with demonstration of Disciple-CD)

Chapters 1, 2, Sections 3.1, 3.5.1, 4.1–4.3, 4.6, 5.1–5.6, 5.10, 6.1–6.8, 6.10, Chapter 7, Sections 8.1–8.4, 8.6, 9.1–9.5, 9.7, 10.1–10.9, 10.11, Chapter 11

General Introduction to Intelligence Analysis (with an introduction to Disciple-CD)

Chapters 1, 2, Sections 3.1, 3.5.1

Intelligence Analysis (with basic use of Disciple-CD)

Chapters 1–3, Sections 4.1–4.4, 4.6, 5.1–5.7, 5.9, 5.10, 6.1–6.8, 6.10

Advanced Intelligence Analysis (with basic use of Disciple-CD)

Chapters 1–3, Sections 4.1–4.4, 4.6, 5.1–5.7, 5.9, 5.10, 6.1–6.8, 6.10,

Chapters 7–12

Intelligence Analysis (with advanced use of Disciple-CD)

Chapters 1–6

Advanced Intelligence Analysis (with advanced use of Disciple-CD)

Chapters 1–12

Naturally, we hope that your learning venture with or without the assistance of Disciple-CD will be a most valuable experience in which you will discover many very important elements of intelligence analysis, some of which you might not have heard anything about before. We also hope that this venture will be directly relevant to tasks you face, or will face, every day in your analytic careers. Finally, we hope that it will be as enjoyable as it will be informative. So, as you begin this learning venture, we wish you *bon voyage!*

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