

# **Process Tracing: Introduction and Exercises<sup>1</sup>**

To Accompany *Rethinking Social Inquiry*, 2nd Edition

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Comments and Corrections Invited

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## 1. Introduction

Process tracing is a fundamental tool of qualitative analysis, and improving the understanding and application of this tool is a central goal in the second edition of *Rethinking Social Inquiry* (*RSI*-2). Too often, process tracing is not adequately taught and it is not adequately understood among researchers who claim to use this tool.

This deficit motivates us to include in *RSI*-2 three chapters<sup>2</sup> that explore different facets of process tracing. It also leads us to present here a further overview of this method, along with exercises for teaching it. The exercises address two examples from international relations, one from American politics, two from comparative politics, and one from public health/epidemiology. A seventh example is based on the Sherlock Holmes story “Silver Blaze,” which is also a running illustration in the Introduction (below). It may be useful to read the Holmes story before the Introduction, although the presentation should be self-explanatory on its own. Methodological ideas from two other Sherlock Holmes stories are also introduced in the text. Obviously, Sherlock Holmes is not social science, but it engagingly illustrates key ideas that are central to the six social science exercises.

The following text includes (1) an overview of process tracing, (2) teaching exercises, (3) a bibliography, and (4) the Sherlock Holmes story.

## 2. Bridging Three Perspectives

This discussion connects three methodological ideas. The overall analytic framework is that of (1) *process tracing*, which Bennett (*RSI*-2, chap. 10) has systematized in a typology of four hypothesis tests. Process tracing, in turn, is a set of procedures for analyzing data that takes the form of (2) *causal-process observations*.<sup>3</sup> Finally, (3) the *causal sequence framework*, formulated by Mahoney (2010: 125–31),<sup>4</sup> places these same process-tracing tests and the hypotheses they evaluate within a larger explanatory structure. The integration of these three components provides valuable leverage for causal inference in qualitative research.

To be more specific: *Process tracing* examines diagnostic pieces of evidence—often understood as part of a temporal sequence of events or phenomena—with the goal of achieving and refining causal inference. Process tracing tests are seen as having distinctive probative value in supporting or overturning explanatory hypotheses, and these tests are a fundamental tool in qualitative research. In addition, given the close engagement with cases and fine-grained case knowledge that are central to process tracing, this procedure enriches description and thereby contributes to descriptive inference as well.

*Causal-process observations* (CPOs)<sup>5</sup> are precisely these diagnostic pieces of evidence examined in process tracing. Drawing on Sherlock Holmes, one may convey the idea of CPOs by

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<sup>2</sup> Bennett, Freedman, and Brady, chaps. 10, 11, and 12.

<sup>3</sup> This connection is underscored in *RSI*-2, pp. 201–02, and in Brady’s chap. 12.

<sup>4</sup> In the discussion below, Mahoney’s framework is slightly modified, in that the category of dependent variable tests is added.

<sup>5</sup> Causal process observations are discussed in *RSI*-2, chaps. 9, 12, and 13; Brady, Collier, and Seawright 2006; Collier, Brady, and Seawright 2010.

also calling them “clues.” CPOs are the specific pieces of data on which the researcher focuses in process tracing. With regard to causal inference, they provide leverage for adjudicating among alternative hypotheses. In addition, as already noted, close examination of CPOs is a key tool for descriptive inference. With the idea of CPOs, we maintain that the data of qualitative research deserves a status parallel to that of *data-set observations* (DSOs),<sup>6</sup> which are the information contained in the standard data set of quantitative researchers.

The *causal sequence framework* situates the arguments evaluated in process-tracing tests in relation to standard hypotheses and variables discussed in causal inference. Thus, one asks, what are the hypothesized independent variables, the dependent variable, and the mechanisms (which may also be called intervening variables) that may connect them? Recognizing the place of the tests in this framework further clarifies the contribution of process-tracing to causal inference.

### 3. Process Tracing

Basic ideas about process tracing can be summarized in terms of four empirical tests, which evaluate evidence in distinct ways. The tests are classified based on two criteria: whether passing the test is *necessary* for establishing a causal connection, and whether it is *sufficient* for establishing a causal connection. These criteria in turn group the tests regarding the implication for rival hypotheses. Based on these criteria, the typology in Table 1 situates four possible tests: *straw-in-the-wind*, *hoop*, *smoking gun*, and *doubly decisive*.

**Table 1. Process Tracing: Types of Tests<sup>1</sup>**

		Sufficient to Establish Causation <sup>2</sup>	
		No	Yes
		1. Straw in the Wind Test	3. Smoking Gun Test
No	Necessary To Establish Causation	<i>Passing:</i> Affirms relevance of hypothesis, but does not confirm it	<i>Passing:</i> Confirms hypothesis
		<i>Failing:</i> Suggests hypothesis not relevant, but does not eliminate it	<i>Failing:</i> Does not eliminate it
Yes	Necessary To Establish Causation	<i>Implication for rival hypotheses:</i> None	<i>Implication for rival hypotheses:</i> None
		2. Hoop Test	4. Doubly Decisive Test
		<i>Passing:</i> Affirms relevance of hypothesis but does not confirm it	<i>Passing:</i> Confirms hypothesis and eliminates others
Yes		<i>Failing:</i> Eliminates it	<i>Failing:</i> Falls short in establishing sufficiency and/or necessity
		<i>Implication for rival hypotheses:</i> None	<i>Implication for rival hypotheses:</i> passing eliminates them, as noted above

<sup>1</sup> This table is adapted from Bennett (2010: 210). It builds on categories initially formulated by Van Evera (1997: 31–32).

<sup>2</sup> In this table, “establish causation,” as well as “confirming” or “eliminating” a hypothesis, obviously does not involve a definitive test. Rather, as with any causal inference, qualitative or quantitative, it is a *plausible* test in the framework of a particular data set and of this specific method of inference.

<sup>6</sup> Put another way, a DSO is all the scores in a given row, in the framework of the quantitative researcher’s standard rectangular data set. It is “all the numbers for one case.” Given that the idea of an “observation” is a fundamental building block in quantitative analysis, we deliberately incorporated the term in establishing the label CPO. This does *not* mean that one is directly *observing causation*—an obvious point, given that the entire discussion is about causal inference. See RSI-2, chap. 9.

Before we discuss these tests, some key points about process tracing must be underscored.

**a. Establishing Causation.** In qualitative as well as quantitative research, causal inference is an uncertain enterprise. When we say “establish causation,” the certitude of this inference must be understood in the framework of the particular test, with no implication that the connection is in some absolute way established. The same is of course true of all empirical tests, including those in regression analysis or other forms of quantitative research.

**b. Necessity and/or Sufficiency.** It is well established that reasoning in terms of necessity and sufficiency can be a productive approach to causal inference.<sup>7</sup> Yet these criteria can sometimes be too confining, and they should be understood as providing heuristic standards for discussing evidence.

**c. Boundaries between Tests.** Correspondingly, the distinctions between the tests should not be seen as rigid. Rather, the tests are, to reiterate, heuristic guides for evaluating evidence. For example, based on the researcher’s background knowledge and assumptions, a straw-in-the-wind test might be reinterpreted as establishing the greater degree of certitude entailed in a smoking gun test. Thus, we might say that the result of a straw-in-the-wind test could be *unfavorable* to a given hypothesis, whereas a hoop test justifies *rejecting* it. Yet the distinction here between *unfavorable* and *rejecting* may be a matter of degree, rather than a sharp dichotomy. Although researchers may have a particular type test in mind when the investigation begins, the interpretation of evidence may show that a different type of test is relevant.

**d. Assumptions.** As with any form of inference, process tracing depends on assumptions, and these gradations between tests can involve different choices about assumptions. For example, if researchers believe the joint occurrence of two events or pieces of evidence occurred by coincidence, they should and will be more cautious. Alternatively, if their chain of reasoning suggests that this joint occurrence is not a coincidence, they may well arrive at a stronger conclusion about accepting or rejecting the hypothesis under consideration.

Sherlock Holmes takes a strong stand regarding assumptions about coincidences. In one story,<sup>8</sup> Watson refers to the juxtaposition of two key events as “an amazing coincidence.” Holmes replies: “A coincidence! The odds are enormous against its being a coincidence. No figures can express them. No, my dear Watson, the two events are connected—*must* be connected. It is for us to find the connection.”<sup>9</sup> Ironically, it turns out that the two events are only tangentially connected, so Watson’s reasoning was closer to the truth than Holmes’s, and the weaker assumption was more appropriate.<sup>10</sup>

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<sup>7</sup> In the field of qualitative methodology within political science, a large body of recent literature on this topic has grown out of Goertz and Starr (2002).

<sup>8</sup> See “Adventure of the Second Stain,” in Doyle 1930: 655.

<sup>9</sup> In another story, Holmes is initially more cautious about inferences and coincidences, but then he emphatically backtracks and insists on the certitude of his inferences. See “The Sign of Four,” in Doyle 1930: 93.

<sup>10</sup> Of course, the point here is not that with such assumptions the investigator necessarily “stacks the deck” in favor of a certain hypothesis. Assumptions are central to any form of inference. The point is to be aware of them, and to make them as realistic as possible.

**e. Qualitative versus Quantitative.** The methodology of process tracing and CPOs is not intended to confine scholars to qualitative analysis. In the spirit of multi-method research, investigators must make careful choices—at a given point in a particular study or in an evolving literature—about which combination of CPOs and DSOs is more effective for answering research questions.

Against this backdrop, we discuss the four process-tracing tests in the typology above, introducing at every step examples from the Sherlock Holmes story (Table 2).<sup>11</sup>

**Table 2. Overview of Sherlock Holmes Story, “Silver Blaze”**

**Causal Puzzle**

To explain the murder of John Straker and the disappearance and whereabouts of the racehorse Silver Blaze.

**Main Characters**

Silver Blaze, the racehorse that is the favorite for the Essex Cup, has disappeared.

John Straker, the horse’s trainer, has been killed by a terrible blow that shattered his head.

Fitzroy Simpson, a prime suspect, has been lurking around the stable, seeking inside information about the race.

Ned Hunter, a stable boy, has been drugged with opium concealed in curried mutton. He therefore fails to guard Silver Blaze on the night of the horse’s disappearance.

Colonel Ross is the owner of King’s Pyland Stables and of Silver Blaze.

*Straw-in-the-wind* tests can increase the plausibility of a given hypothesis, or raise doubts about it, but they are not decisive by themselves. They provide *neither a necessary nor a sufficient* criterion for supporting or rejecting a hypothesis, and they have no implications for rival hypotheses. In this sense they are the weakest of the four tests in this typology, and they place the least demand on the researcher’s knowledge and assumptions. Yet they can be valuable benchmarks in an investigation. In “Silver Blaze,” a straw-in-the-wind test (Table 3), based on one of the most famous clues in all of detective fiction, pointed to the possibility that Straker abducted the horse.

**Table 3. Straw-in-the-Wind Test**

**Hypothesis 3.** Straker abducted the horse.

**CPO/Clue.** The dog did nothing in the night during which the horse disappeared. (This is one of the most famous clues in all of detective fiction.)

**Inference.** Holmes infers that the dog did nothing because the person who approached the stable was Straker, the dog’s owner. This raises questions about why Straker went to the stable. It hints at some possibilities, but does not demonstrate them one way or another.

**Summary of Test.** A *straw-in-the-wind test* that is consistent with, but does not confirm, the hypothesis.

See also **Hypotheses 5b** below.

*Hoop tests* involve a more demanding inference. Although they cannot provide direct support for a hypothesis, they can eliminate a hypothesis. Thus, while not providing a *sufficient* criterion for accepting the explanation, they establish a *necessary* criterion. A hypothesis must ‘jump through

<sup>11</sup> Each example here is concerned with explaining a singular event in the overall causal puzzle. Of course, these tests are also valuable for evaluating explanations of recurring events. Both event types are addressed in the exercises below.

the hoop'' to remain under consideration, but success in passing a hoop test does not affirm the hypothesis. Like the straw-in-the-wind test, the hoop test has no implications for rival hypotheses. In the Holmes story, Simpson passes the first hoop test (4a in Table 4), leaving open the possibility that he killed Straker, yet a further hoop test (4b) makes that implausible.

**Table 4. Hoop Tests**

**In these examples, 4b supersedes 4a**

**Hypothesis 4a.** Simpson killed Straker.

**CPO/Clue.** Simpson had a potential murder weapon.

**Inference.** This weapon is consistent with the hypothesis but does not by itself prove Simpson's guilt.

**Summary of Test.** The hypothesis that Simpson killed Straker passes this *hoop test*.

**Hypothesis 4b.** Simpson killed Straker.

**CPOs/Clues.** Simpson's timid, non-menacing appearance, plus the fact that Straker's "head had been shattered by a savage blow from some heavy weapon."

**Inference.** Simpson appears an unlikely candidate for inflicting the blow that shattered Straker's head. This overrides Hypothesis 4a. Of course, a timid-looking person could commit an unusually violent murder, which makes further evidence necessary for confirming or rejecting the hypothesis.

**Summary of Test.** The hypothesis fails this (possibly weak) *hoop test*, which makes Simpson's guilt implausible.

*Smoking gun* tests likewise involve a more demanding inference. The metaphor conveys the idea of a suspect caught holding a smoking gun, though of course in the context of discussing a murder mystery, this can be taken figuratively rather than literally. These tests can strongly support a given hypothesis, but failure to pass a test does not reject it. They provide a *sufficient but not necessary* criterion for confirmation. As with the prior two tests, they have no implications for rival hypotheses.

In our illustrations from Sherlock Holmes, the first example (5a in Table 5) is a straight-forward smoking gun test. The assessment of Hypothesis 5b illustrates the more demanding inference required by this test. Thus, this might be interpreted as a straw-in-the-wind test, but with a stronger assumption it becomes a smoking gun test.

**Table 5. Smoking Gun Tests**

**Hypothesis 5a.** One or more members of Straker's household were central to a step in the chain of events.

**Clues/CPOs.** Curried mutton, opium, and drugging of stable boy.

**Inference.** Holmes infers that the curry was needed to conceal the opium, which in turn was used to drug the stable boy. Once it becomes clear that the curry could only have been introduced in the mutton by someone in Straker's household, members of his household become inextricably linked to a key causal step.

**Summary of Test.** These clues provide *smoking gun* evidence that confirms Holmes's hypothesis.

**With a stronger assumption, a straw-in-the-wind test becomes a smoking gun test.**

**Hypothesis 5b.** Straker planned to commit harm.

**CPO/Clue.** Surgical knife.

**Inference.** The sophisticated surgical knife suggested, but did not confirm, the inference that Straker had a well-planned intent to commit harm. It might possibly be a coincidence, and this might be interpreted as a *straw-in-the-wind* test that he passes.

**Alternative Inference.** The knife could be seen as *exceedingly* unusual—strongly suggesting that this could not be a coincidence, pointing to intent to harm, and constituting a *smoking gun* test.

**Summary of Test.** If one makes a stronger assumption that its presence could not have been a coincidence, then this clue might alternatively be treated as yielding a *smoking gun* test that confirms the hypothesis.

*Doubly-decisive* tests confirm one hypothesis and eliminate all others. Ideally, one hypothesis would be decisively supported, as with a smoking-gun test, and alternative hypotheses would be rejected, as with hoop tests. Yet being realistic, a strong version of these tests may not be possible. One alternative is to combine the hoop test with what may be thought of as Holmes's variant of the method of residues, which he summarizes various times in the stories with the argument that “when you have eliminated the impossible, whatever remains, however improbable, must be the truth.” For this further test to work, the researcher must successfully identify all rival hypotheses. This test is illustrated in Table 6, based on the hypothesis that the horse killed Straker. Here, one of the component tests is initially a straw-in-the-wind, but Holmes's method of elimination strengthens this test.

**Table 6. Doubly-Decisive Test**

**Hypothesis 6.** The horse killed Straker.

**CPOs/Clues.** Simpson appeared after the curried mutton had been prepared, and his manner was timid and non-menacing; Straker not only had an unusual surgical knife, but also matches and a candle; Straker's head was “shattered by a savage blow from some heavy weapon.”

**Inferences.** It was impossible that Simpson could have introduced the curry or opium into the mutton; and given his timid and non-menacing manner, he was unlikely to have struck this terrible blow. Hence, *Simpson is eliminated*.

Given the nature of the blow, Straker did not kill himself. Hence, *Straker is eliminated*.

Straker appeared to be preparing a potentially dangerous plan to harm the horse, given the extremely unusual surgical knife. It probably occurred in the darkness, given the matches and candle, and given the timing of the horse's disappearance. In response to the lighting of a match, the candle, and a potential attempt to harm—a kick from the horse was a possible reaction that could have had the effect of shattering Straker's head, as if “by a savage blow from some heavy weapon.” Depending on how strongly one is concerned about the possibility of a coincidence, this may be a *straw-in-the-wind* test or with a stronger assumption, a *smoking-gun* test.

The stronger assumption could be supported by a variant of the method of elimination that Holmes periodically invokes: “when you have eliminated the impossible, whatever remains, however improbable, must be the truth.” The horse might have seemed an unlikely suspect, but the other plausible possibilities had been eliminated.

**Recapitulating the Test.** Hoop tests eliminate two suspects. Based on an inference derived from what one could situate between a *straw-in-the-wind* and *smoking gun* test—the horse became a highly plausible suspect. The supplementary procedure of Holmes's method of elimination effectively confirms the argument that this is a *smoking gun* test.

**Summary.** Two *smoking gun* tests yield a *doubly-decisive* test.

The causal sequence framework situates process-tracing in relation to basic questions of causal inference familiar to all researchers. Our reasoning about causal inference is routinely organized around a well-defined sequence of steps: the outcome being explained (dependent variable), alternative explanations (independent variables), and the mechanisms that might link cause and effect (intervening variables). A given process-tracing test may yield insight into different parts of this sequence, and understanding where the test is located clarifies what the test contributes to causal inference (Table 7).

Although we refer here to the causal sequence framework, and though process tracing focuses centrally on causal inference, as noted above the close engagement with cases can yield a more nuanced descriptive understanding as well, which in turn strengthens causal inference.

**Table 7. Causal Sequence Framework: Situating Process Tracing Tests**

**Descriptive Inference**

Close engagement with cases sharpens description at every step in the sequence.  
This is crucial in its own right, and is also crucial for meaningful causal inference.

**Causal Inference**

Independent Variables

- a. Seeking explanatory hypotheses
- b. Establishing the range of independent variable for a given hypothesis

Mechanisms

Dependent Variable

- a. Evaluating a plurality of causes
- b. Evaluating unique effects

Auxiliary Outcomes

**Independent Variable Tests.** These tests yield insight into the independent variables themselves and how they relate to other variables. Two forms of inference may be involved here.

*a. Seeking explanatory hypotheses.* Researchers may not have a definite hypothesis that identifies relevant independent variables, and they may seek new hypotheses. Table 8 illustrates an inductive process-tracing assessment that directed Holmes's attention to a possible explanation.

**Table 8. Situation Process-Tracing Tests: Discovering an Independent Variable**

**Hypothesis 8.** Romantic entanglement set chain of events into motion.

**CPOs/Clues.** The bill in Straker's pocket from an expensive women's clothing store, and his wife's ignorance of the dress.

**Inference.** Holmes suspected the bill was in fact owed by Straker. Holmes's subsequent question to Straker's wife confirmed that the clothing was not for her, posing the possibility of an expensive entanglement with another woman and corresponding financial difficulties—that might have had some bearing on the case.

**Summary of Test.** This was a promising lead, a *straw-in-the-wind* that lent weight to Holmes's suspicions, but was not a decisive piece of evidence.

*b. Establishing the range of a hypothesized variable.* Alternatively, researchers may have a definite hypothesis about the effects of the independent variable, but they may wish to confirm that this variable actually assumes the value(s) relevant to the hypothesis. In a case study, a given CPO often assumes one value, and its range is routinely understood against a theoretical expectation, rather than against other observations. Table 9 illustrates an independent variable test that places a particular observation in relation to an implicit range of this kind. The example is an obvious one, but it is important for Holmes's inferences.

**Table 9. Situating Process-Tracing Tests: Establishing the Range of an Independent Variable—Based on Comparison with Theoretical Expectations, Rather than with other Observations**

**A Crucial Descriptive Inference**

Holmes establishes that the suspicious dress, which appears to be situated at the start of the causal sequence, was very expensive. He somewhat facetiously remarks that the woman involved "had somewhat expensive tastes...." "Twenty-two guineas is rather heavy for a single costume."

The idea of establishing the range of the dependent variable is also illustrated by Mahoney's (2010: 127–28) discussion of Tannenwald. She argues that the horrified reaction of U.S. policy-makers to the use of nuclear weapons at the end of World War II influenced subsequent nuclear policy.<sup>12</sup> As an antecedent step in the causal sequence, it must be established empirically that this horrified reaction did in fact occur. In this case, process tracing focuses on diagnostic evidence to establish this fact.

The Tannenwald example also illustrates the point that a shift from CPOs to data set observations (DSOs) should sometimes be considered. Unsurprisingly, the quantity and type of data available will influence the form of the test. If it appears that greater leverage derives from focusing on only a few pieces of information, and/or if only a few observations are available, then the researcher should focus on CPOs. If it appears that quantitative analysis will yield greater leverage and much more information is available—for example, extensive data about different types or intensities of “horrified reactions”—then the researcher might construct a conventional quantitative data set and undertake a test based on DSOs rather than CPOs. Often, it is productive to follow both strategies.

**Dependent Variable Tests.** These tests yield inferences about the outcome at the end of the causal chain. As with all the causal sequence tests, dependent variable tests can potentially help to fine-tune, disaggregate, or in other ways sharpen understanding of the outcome to be explained. Two further, distinctive objectives can also be identified.

1. *Plurality of causes*—i.e., equifinality. Here the goal may be to demonstrate that different causes produce the *same* outcome. This focus may arise either within the particular study, or in comparison to other studies. This perspective calls for establishing with a high degree of certainty that the two or more causes yield a common outcome.

2. *Unique effects*. Alternatively, the researcher may explore the possibility that each cause might have a *unique effect*, in the sense of William James's famous dictum that “every difference must make a difference.”<sup>13</sup> In this case, a key goal is to establish that the outcomes really are different.

William James's observation has special importance for Holmes's method of inference. To the extent that distinctive causes produce distinctive outcomes, then distinctive outcomes may possibly (though not necessarily) have distinctive causes. Hence, as Holmes puts it to Watson at one point, “the grand thing is to be able to reason backward,” from the outcome to the cause.<sup>14</sup> In the “Silver Blaze” story, reasoning backward from the distinctive form of Straker's death was crucial for Holmes's inferences (Table 10).

**Table 10. Situating Process-Tracing Tests: Dependent Variable—Unique Effects**

**Hypothesis 10.** The distinctive type of death had a distinctive cause (see Hypothesis 6b).

**Clue/CPO.** “His head had been shattered by a savage blow from some heavy weapon.”

**Test/Inference.** Reasoning back from this distinctive form of death is crucial to Holmes in solving the case.

**Summary of Test.** *Straw-in-the wind, possibly smoking gun.*

<sup>12</sup> Tannenwald's study is also discussed in RSI-2, pp. 189–90; and Collier, Brady, and Seawright 2010.

<sup>13</sup> On William James see Copi 1953: 331–32. To put this in a less extreme form, it might be hypothesized that *some* differences make a difference. On equifinality see George and Bennett 2005: 10, 20, 157.

<sup>14</sup> Doyle, “A Study in Scarlet,” 1930: 83.

A final point must be made about dependent variable CPOs. Here again it may be productive for scholars—who begin by looking at dependent variable CPOs—to make a transition to framing them as DSOs. This can facilitate systematic comparison within or across contexts. This possibility comes up, for example, in Exercise 6 below, which addresses the Lerner study.

**Mechanism Tests.** These tests yield inferences about hypothesized intervening events and processes in the causal sequence. They correspond most closely to scholars' conventional understanding of process tracing. In the Holmes story, the surgical knife is clearly a “device” or mechanism central to the causal sequence (Table 11).

**Table 11. Situating Process-Tracing Tests: Mechanism**

**Hypothesis 5b** above focused on the surgical knife, clearly a device or mechanism in the chain of events

**Auxiliary-Outcome Test.** These tests employ information about outcomes that are peripheral to the core causal process, with the goal of making inferences about this core process. Thus, a particular independent variable or mechanism hypothesized to contribute to the final outcome may also lead to an auxiliary outcome. The inference derived from this test may further confirm the existence of the mechanism. In Holmes, the lame sheep are an excellent example of an auxiliary outcome (Table 12).

**Table 12. Situating Process-Tracing Tests: Auxiliary Outcome**

**Hypothesis 12.** Straker practiced in preparation for injuring the horse.

**CPO/Clue.** Lame sheep.

**Inference.** The lameness of the sheep leads Holmes to infer that Straker might have been practicing a delicate operation with his surgical knife—through which he possibly sought to cause an undetectable injury to the horse. The lameness was not a step in the explanatory chain, but it yields a useful inference about that chain.

**Summary of Test.** *Straw-in-the wind.* With stronger assumptions, *smoking gun*.

Given that auxiliary outcomes stand outside the familiar litany of “dependent variable, independent variable, and mechanism,” it is productive to illustrate these tests further with Mahoney’s social science example: Luebbert’s (1991) famous book, *Liberalism, Fascism, or Social Democracy*. Luebbert’s central argument is that a “red-green” coalition between socialist parties and the middle peasantry was a key factor in the formation of national-political economies in interwar Europe. Mahoney argues that while Luebbert develops this claim in part through small-N comparative research and in part through mechanism [tests], he builds the case by arguing as well that if a red-green alliance really did foster social democracy, it should have left behind other markers. These include a reluctance of socialists to challenge the distribution of wealth in the countryside and an inability of socialists to rely on the middle peasantry as viable electoral base. (Mahoney 2010: 130)

The discovery of such auxiliary outcomes suggests that the red-green alliance had a key influence on other domains of national politics. This finding reinforces the idea that the alliance

was highly influential, giving us stronger grounds for inferring that the alliance also influenced national political-economic regime itself (Mahoney 2010: 130).

\* \* \*

To summarize this overview of process tracing and the causal sequence framework: these tools provide a new and more complete picture of how qualitative analysis can be systematized and effectively applied. The following exercises provide an opportunity to apply these methods.

## 5. Exercises

The following exercises are designed for teaching and learning process tracing. The first four focus on chapters in *Rethinking Social Inquiry*.<sup>15</sup> Four other chapters in *RSI-2*<sup>16</sup> are also directly relevant to the exercises. Another exercise focuses on the Sherlock Holmes story already discussed, and the text of that story is found below. The other two—Lerner and Schultz—involve chapters in readily available published volumes.

An important question concerning the qualitative tools discussed here is whether they are applied to explanatory puzzles involving singular events, or whether they involve multiple events, either at one point in time or over time. The point is that process-tracing is relevant for both. Exercises 1 and 6, based on Bennett and Schultz, focus on singular events in international relations, and the Sherlock Holmes story also concerns a singular event. Freedman focuses on discoveries about recurring patterns in the study of disease; Brady analyzes mass political behavior; and the Lerner case study examines change in the population of a Turkish village.

### Exercise 1. Bennett on Process Tracing in International Relations

Bennett, Andrew. 2010. “Process Tracing and Causal Inference.” *RSI-2*, chap. 10, pp. 207–19.

**Introduction.** Bennett uses three case studies from international relations to exemplify the use of process-tracing in causal inference. Throughout the chapter, he is explicit about which test is being applied at each step, making this a valuable example.

1. Bennett presents 17 hoop tests, one straw-in-the-wind test, and two smoking gun tests. Revisit these 20 tests and summarize each, consulting as needed with the typology in Table 1. In your summaries, follow the format in Tables 3–6 above.
2. Would you amend any of Bennett’s classification of these tests—i.e., his categorization of the tests as hoop, straw-in-the-wind, or smoking gun? The distinctions among the tests should not be seen as rigid boundaries. Would you place some of the tests in an intermediate position between categories, or even in a different category?
3. Classify Bennett’s process-tracing tests in terms of the causal sequence framework (Table 7). What (if any) further insight derives from applying this classification? Why?
4. Given the available evidence and the specific hypothesis being evaluated, which of Bennett’s tests do you find most convincing? Are there others that you find much less convincing? Explain *why* some inferences are more convincing, and others less so.

### Exercise 2. Freedman on Qualitative Evidence in Epidemiology

Freedman, David A. “On Types of Scientific Inquiry: The Role of Qualitative Reasoning.” *RSI-2*, Chap. 11,

**Introduction.** The statistician David Freedman argues that qualitative evidence plays a crucial role in major scientific breakthroughs in epidemiology. These innovations in the study of

<sup>15</sup> Rogowski (chap. 4), Bennett (chap. 10), Freedman (chap. 11), and Brady (chap. 12).

<sup>16</sup> Bartels (chap. 4), Collier, Brady and Seawright (chap. 9), Seawright (chap. 13), and Dunning (chap. 14).

disease, quite apart from their great importance for public policy, are highly relevant for the social sciences. Both areas of investigation routinely pose the familiar challenge of basing causal inference on observational data, frequently in large-N studies—with all the pitfalls thereby entailed. Further, as is clear in these examples, studies from epidemiology also provide fertile ground for illustrating how qualitative evidence contributes to specifying statistical models. Freedman sees this qualitative evidence as so important that it is in its own right a “type of scientific inquiry,” as is clear in the title of his chapter.

Freedman examines six major breakthroughs in the history of epidemiology, which include establishing the cause of cholera, puerperal/childbed fever (in the 19th century, a devastating cause of death for new mothers), pellagra, and beriberi, as well as discovering penicillin and smallpox vaccination. Freedman’s goal is to demonstrate that qualitative evidence makes a crucial contribution and to show how qualitative and quantitative analysis work together in these discoveries.

1. Make an inventory of the process-tracing tests that play a key role in each study examined by Freedman, again following the typology in Table 1 and the format used in Tables 3–6 above.
2. Locate these tests within the causal sequence framework (Table 7).
3. Freedman (p. 232) argues that in his examples, qualitative evidence contributes to three tasks: “refuting conventional ideas if they are wrong, developing new ideas that are better, and testing the new ideas as well as the old ones.” Discuss specifically how each observation contributes to one or more of these tasks.
4. Reread in Freedman’s chapter the discussion of John Snow’s famous work on the causes of cholera, and also examine closely the discussion of Snow in Dunning’s Chapter 14 in *RSI-2*, including the placement of Snow in Dunning’s Figures 14.1, 14.2, and 14.3. Both Freedman and Dunning underscore the importance of integrating qualitative and quantitative evidence. Are both types of evidence important in Snow’s study? If so, why? What are the wider implications for multi-method research that can be drawn from this example?
5. Consider a point closely related to Question 4. If Snow’s superb natural experiment provides exceptionally strong causal inference, then why should qualitative evidence be relevant? Might this possibly be a “least likely” case for finding a decisive contribution of qualitative evidence? Discuss.

### **Exercise 3. Brady on Media Effects in the 2000 Presidential Election**

Brady, Henry E. 2010. “Data-Set Observations versus Causal-Process Observations: The 2000 U.S. Presidential Election.” *RSI-2*, chap. 12.

**Introduction.** Brady’s chapter debates the findings of John Lott, who uses regression analysis to demonstrate that in the 2000 presidential election in Florida, the early and incorrect media call in favor of Gore strongly suppressed the Bush vote in the Florida Panhandle. The Panhandle is on Central Time, and presumably the media call discouraged Bush voters from going to the polls just at the end of the day. Lott claims that Bush therefore lost at least 10,000 votes. Brady disagrees, using a series of CPOs to demonstrate that the early media call had virtually no effect.

1. Make an inventory of the process-tracing tests employed by Brady, again following the format in Tables 3–6 above.

2. Locate these tests within the typology in Table 1, and in the causal sequence framework.
3. State the contrasting hypotheses of Lott and Brady. What kind of evidence is appropriate for supporting or eliminating each? Which test should be used with each piece of evidence?
4. Brady's tests are based on numerical information. Why, then, does Brady present this as an example of causal-process observations, which are typically associated with qualitative analysis?
5. In parallel with the point regarding Freedman's discussion of John Snow raised above (Exercise 3, Question 5), Brady suggests (p. 242) that his study is also a "least likely" case for the relevance of qualitative evidence. He feels that this makes his methodological argument all the more compelling. Discuss.
6. Brady states (p. 241) that if he were to pursue the analysis further, he would seek out additional CPOs, rather than developing new DSOs—notwithstanding the fact that he is working in a domain of mass political behavior. Discuss.

#### **Exercise 4. Rogowski on Juxtaposing CPOs with Strong Theory**

Rogowski, Ronald. 2010. "How Inference in the Social (but Not the Physical) Sciences Neglects Theoretical Anomaly." *RSI-2*, chap. 5

**Introduction.** Rogowski underscores the importance of the researcher's theoretical expectations for testing hypotheses in case studies. This is crucial in all process-tracing tests, and it is valuable to make it a central point, as Rogowski does. He focuses on examples in which the results of specific tests overturn prior hypotheses, and like Freedman (2010: 233 and *passim*), he underscores the value of looking for anomalies.

1. In his brief discussion of Lijphart, Allen, and Gourevitch (pp. 91–93), Rogowski argues that observations from a single case decisively overturn a prior line of argument. For each of these examples: (a) Summarize the prior line of argument; (b) In the causal sequence framework, which kind of test is involved in each example (e.g. independent variable, mechanism, or dependent variable, auxiliary outcome)? (c) Given the information provided, are you as convinced as Rogowski that these CPOs justify a strong rejection of the hypothesis?
2. Rogowski (p. 93) also comments on the Heberle study (p. 93). (a) State the prior line of argument to which Heberle's study is relevant; (b) Would you say that this is a study of a single case, or is it a small-N comparative study? Put another way, is the analysis based on CPOs or DSOs? (c) Is Heberle concerned with "covariation" between variables, and if so, what does he infer from it? (d) What substantive conclusion emerges, based on Heberle's findings?
3. Rogowski (p. 90) also discusses the famous 1919 test of Einstein's Theory of Relativity. Based on celestial observations made from Brazil and West Africa, in this test Eddington found the predicted magnitude of deflection of light from stars during solar eclipse. This observational (not experimental) case study played an important role in the wide acceptance of Einstein's theory.<sup>17</sup> (a) Does this test involve a CPO, given that it is based on numerical information? In answering this question, consider again Question 4 from the Brady exercise. (b) Is this science example helpful in buttressing Rogowski's argument?

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<sup>17</sup> See, for example, Rogowski, p. 90, n. 4.

4. Rogowski (p. 78) summarizes King, Keohane, and Verba's (KKV's) bruising critique of case studies, including in his statement a quote from their text. Thus, Rogowski points out that notwithstanding what he views as the valuable inferences derived from the case studies he discusses,

KKV contends that “in general...the single observation is not a useful technique for testing hypotheses or theories” [quoted from KKV, p. 211], chiefly because measurement error may yield a false negative, omitted variables may yield an unpredicted an unpredicted result, or social-scientific theories are insufficiently precise. [KKV] would have us accept that the Lijphart, Allen, and Gourevitch studies...were bad science.... (Rogowski 2010: 93)

Evaluate KKV's position. Consider the implicit premise that quantitative studies can in fact avoid these flaws. Evaluate this premise in light of Bartels's (*RSI*-2, chap. 4) view of measurement error in quantitative research; and Seawright's (*RSI*-2, chap. 13) discussion of problems such as omitted variables in regression studies. What balance would you strike here?

### **Exercise 5. Sherlock Holmes, “Silver Blaze”**

Conan Doyle, Arthur. 1982. “The Adventure of Silver Blaze.” Originally published in *Strand Magazine* Vol. 4., December 24: 645–660 (George Newnes Ltd, London). This story is included at the end of this file.

**Introduction.** This Sherlock Holmes story is unusually rich in examples of process tracing tests. A number have been illustrated above, but others in the story remain to be discussed and examined. Note that the copy of the story included below is a searchable text, making it easy to look for clues and place them in context.

1. In addition to the hypotheses, CPOs/clues, and inferences reported in Tables 3–6 and 8–12 above, make an inventory of those not included in these tables, again following the same format.
2. Locate these tests in the typology in Table 1 and in the causal sequence framework.
3. Summarize the advantages and disadvantages of using an example from detective fiction to illustrate methodological tools for the social sciences.
4. Discuss other information in the story that gives insight into Holmes's process of reasoning about this case. You will recall from above that Holmes routinely says to Watson that “it is a capital mistake to theorize before you have all the evidence.”<sup>18</sup> Is this a good characterization of how Holmes's mind works?

### **Exercises Based on Other Readings**

#### **Exercise 6. Schultz on the Fashoda Crisis: A Further Look**

Schultz, Kenneth A. 2001. *Democracy and Coercive Diplomacy*. New York: Cambridge University Press, pp. 175–196.

**Introduction.** This section of Schultz's 2001 book is the principal source employed in Bennett's brief analysis of the Fashoda crisis of 1898. In this crisis, Britain and France resolved their

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<sup>18</sup> “A Study in Scarlet,” Chapter 3, in Doyle 1930.

competing imperial claims to the Upper Nile Valley without resorting to the use of force. This event presented a valuable opportunity for testing the mechanisms underlying the inter-democratic peace hypothesis—i.e., that democracies do not go to war with one another.

1. Examine Schultz's analysis closely. Does his far more detailed discussion (22 pages, versus one page in Bennett) yield an analysis that converges with Bennett's, or does it cast any of Bennett's tests in a different light?
2. Does Schultz explicitly or implicitly offer tests not included in Bennett's discussion?
3. Schultz discusses explanations at two levels: broad explanatory approaches—for example, neorealism and the theory of democratic peace—and also specific hypotheses, which are partly derived from these theories and partly from elsewhere. Discuss how arguments from these two levels are evaluated through process-tracing and what findings emerge.
4. One of the early explanations offered for the lack of wars between democracies is that democratic publics will not be belligerent because they will not want to impose the costs of a war upon themselves. (a) What kind of evidence does Schultz provide that is relevant to this non-belligerency hypothesis, which process-tracing test serves to assess this evidence, and how does the test come out? (b) Given the evidence provided, how plausible is the non-belligerency hypothesis compared to Schultz's own explanation, which focuses on the transparency of domestic political processes in democracies.
5. *Note: This final question broadens the focus to arguments presented in Schultz's entire book.* Schultz discusses a number of cases that do not fit his theory, including some major wars—World War I and World War II—as well as the Vietnam War. Yet he does not consider these anomalies in depth. What hypotheses can you offer for why Schultz's theory does not fit these wars? What process tracing test(s) would you use to assess your hypotheses, and what conclusions would you reach?

### **Exercise 7. Lerner on the Turkish Village of Balgat**

Lerner, Daniel. 1958. “The Grocer and the Chief: A Parable.” Chapter 1 in Lerner, *The Passing of Traditional Society: Modernizing the Middle East*. New York: The Free Press. A somewhat abridged version of this case study was published in *Harper's Magazine* 211, No. 1264 (September 1955). As of August 2010, a pdf of this version can be found at <[http://courses.essex.ac.uk/gv/gv905/W5%20lerner\\_grocer\\_chief.pdf](http://courses.essex.ac.uk/gv/gv905/W5%20lerner_grocer_chief.pdf)> .

This chapter examines a dramatic process of “modernization” that occurs in a Turkish village over a very short period of time—between 1950 and 1954.<sup>19</sup> This transformation results from the introduction by a new governing party of innovative infrastructure that includes electricity and a modern road to Ankara. The dramatic change in the village is thus the dependent variable, and the author’s goal is to tease out what modernization means in this context. The Lerner study thus provides excellent practice in using process tracing for descriptive inference, which as

<sup>19</sup> Lerner’s analysis is closely tied to modernization theory, which might concern some readers; and at certain points the presentation seems condescending. Further, on p. 29 the description of the female interviewer is presented in a sexist way (although in survey research selecting interviewers in light of characteristics such as these is widely recognized as important). However, these drawbacks are outweighed by the opportunity presented by the chapter to practice making careful observations, and to see how they can be integrated into a complex picture of social change.

emphasized above can be a key contribution of this methodological tool. This reading includes dozens of specific observations of people, social interactions, and material conditions that provide remarkable insight into this dependent variable. Working closely with the chapter gives the reader excellent practice in searching for fine-grained evidence.

1. Make an inventory of observations about different facets of social, economic, and political change woven into this case study. Observations are provided for both 1950 and 1954; some will involve change over time, and others will reflect a lack of change. Relevant observations involve material objects, physical infrastructure, and commercial establishments; demographic information; and social attributes and interactions. You should be able to find a large number of these observations. Organize the inventory by identifying a smaller number of broad concepts for which these observations serve as indicators, and then list the specific observations.
2. A key idea in Lerner's book (of which this chapter is a part) is that of "empathic capacity," or the empathic personality—a characteristic of individuals who have a strong ability to imagine themselves in different life situations other than their own.<sup>20</sup> Lerner contrasts this with the "constrictive personality" (pp. 49–51). From the inventory developed in response to Question 1 on Lerner, identify evidence about empathic versus constrictive personalities—including evidence regarding change across the two time periods.
3. In Lerner's analysis, the grocer and the chief—and in a sense, also the chief's sons—are metaphors for the larger processes of change. Discuss how this works.
4. In light of Questions 2 and 3 on Lerner, are the pieces of information contained in this case study facets of the dependent variable? If not, explain how they would in fact fit in the causal sequence framework. If so, explain in detail how they do or do not illuminate the dependent variable.
5. Question 1 for the Lerner example suggests that the information in his chapter can be seen as a large number of specific observations that can be grouped together as indicators of a smaller number of concepts. Discuss how a researcher might make a transition from treating these as CPOs, to creating a conventional quantitative dataset involving DSOs. This may be easy to do for some of the aspects of change analyzed in the article, but for others there are just one or two key nuggets of information that should be treated as CPOs.

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<sup>20</sup> As Lerner puts it, "to simplify the matter," this is "the capacity to see oneself in the other fellow's situation." It involves "a high capacity for rearranging the self-system on short notice" (pp. 50, 51).

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## Overview of the Story<sup>1</sup>

First Published in *The Strand Magazine*, December 1892.

Illustrations by Sidney Paget are from the original edition. Captions have been adapted to emphasize the issues of process tracing of concern here.

### Causal Puzzle

To explain the murder of John Straker and the disappearance and whereabouts of the racehorse Silver Blaze.

### Main Characters

Silver Blaze, the horse that is the favorite for the Essex Cup, has disappeared.

John Straker, the horse's trainer, has been killed by a terrible blow that shattered his head.

Fitzroy Simpson, a prime suspect, has been lurking around the stable, seeking inside information about the race.

Ned Hunter, a stable boy, has been drugged with opium concealed in curried mutton. Hence, he fails to guard Silver Blaze on the night of the horse's disappearance.

Colonel Ross, owner of King's Pyland Stables and of the horse.

Among the many Holmes stories, "Silver Blaze" provides some of the best examples of the detective's use of process tracing.

# The Adventure of Silver Blaze

Sir Arthur Conan Doyle



am afraid, Watson that I shall have to go," said Holmes, as we sat down together to our breakfast one morning.

"Go! Where to?"

"To Dartmoor; to King's Pyland."

I was not surprised. Indeed, my only wonder was that he had not already been mixed up in this extra-ordinary case, which was the one topic of conversation through the length and breadth of England. For a whole day my companion had rambled about the room with his chin upon his chest and his brows knitted, charging and recharging his pipe with the strongest black tobacco, and absolutely deaf to any of my questions or remarks. Fresh editions of every paper had been sent up by our news agent, only to be glanced over and tossed down into a corner. Yet, silent as he was, I knew perfectly well what it was over which he was brooding. There was but one problem before the public which could challenge his powers of analysis, and that was the singular disappearance of the favorite for the Wessex Cup, and the tragic murder of its trainer. When, therefore, he suddenly announced his intention of setting out for the scene of the drama, it was only what I had both expected and hoped for.

"I should be most happy to go down with you if I should not be in the way," said I.

"My dear Watson, you would confer a great favor upon me by coming. And I think that your time will not be misspent, for there are points about the case which promise to make it an absolutely unique one. We have, I think, just time to catch our train at Paddington, and I will go further into the matter upon our journey. You would oblige me by bringing with you your very excellent field-glass."

<sup>1</sup> This story is in the public domain. It was published by Public Domain Books, 1 May 1997. The text can be downloaded at no charge from Amazon.com as part of a Kindle Book, *The Memoirs of Sherlock Holmes*. See <[amazon.com/Memoirs-Sherlock-Holmes-ebook/dp/B002RKSWMO/ref=sr\\_1\\_1?ie=UTF8&m=AG56TWVU5XWC2&s=digital-text&qid=1281387633&sr=1-1](https://www.amazon.com/Memoirs-Sherlock-Holmes-ebook/dp/B002RKSWMO/ref=sr_1_1?ie=UTF8&m=AG56TWVU5XWC2&s=digital-text&qid=1281387633&sr=1-1)>. Viewed 9 August 2010.

And so it happened that an hour or so later I found myself in the corner of a first-class carriage flying along en route for Exeter, while Sherlock Holmes, with his sharp, eager face framed in his ear-flapped travelling-cap, dipped rapidly into the bundle of fresh papers which he had procured at Paddington. We had left Reading far behind us before he thrust the last one of them under the seat and offered me his cigar-case.

"We are going well," said he, looking out of the window and glancing at his watch. "Our rate at present is fifty-three and a half miles an hour."

"I have not observed the quarter-mile posts," said I.

"Nor have I. But the telegraph posts upon this line are sixty yards apart, and the calculation is a simple one. I presume that you have looked into this matter of the murder of John Straker and the disappearance of Silver Blaze?"

"I have seen what the *Telegraph* and the *Chronicle* have to say."

"It is one of those cases where the art of the reasoner should be used rather for the sifting of details than for the acquiring of fresh evidence. The tragedy has been so uncommon, so complete, and of such personal importance to so many people that we are suffering from a plethora of surmise, conjecture, and hypothesis. The difficulty is to detach the framework of fact—of absolute undeniable fact—from the embellishments of theorists and reporters. Then, having established ourselves upon this sound basis, it is our duty to see what inferences may be drawn and what are the special points upon which the whole mystery turns. On Tuesday evening I received telegrams from both Colonel Ross, the owner of the horse, and from Inspector Gregory, who is looking after the case, inviting my cooperation."

"Tuesday evening!" I exclaimed. "And this is Thursday morning. Why didn't you go down yesterday?"

"Because I made a blunder, my dear Watson—which is, I am afraid, a more common occurrence than anyone would think who only knew me through your memoirs. The fact is that I could not believe it possible that the most remarkable horse in England could long remain concealed, especially in so sparsely inhabited a place as the north of Dartmoor. From hour to hour yesterday I expected to hear that he had been found, and that his abductor was the murderer of John

Straker. When, however, another morning had come and I found that beyond the arrest of young Fitzroy Simpson nothing had been done, I felt that it was time for me to take action. Yet in some ways I feel that yesterday has not been wasted."

"You have formed a theory, then?"

"At least I have got a grip of the essential facts of the case. I shall enumerate them to you, for nothing clears up a case so much as stating it to another person, and I can hardly expect your cooperation if I do not show you the position from which we start."

I lay back against the cushions, puffing at my cigar, while Holmes, leaning forward, with his long, thin forefinger checking off the points upon the palm of his left hand, gave me a sketch of the events which had led to our journey.



Holmes outlines the case: Is he following his own dictum of not theorizing before he has all the evidence?

"Silver Blaze," said he, "is from the Somomy stock and holds as brilliant a record as his famous ancestor. He is now in his fifth year and has brought in turn each of the prizes of the turf to Colonel Ross, his fortunate owner. Up to the time of the catastrophe he was the first favorite for the Wessex Cup, the betting being three to one on him. He has always, however, been a prime favorite with the racing public and has never yet disappointed them, so that even at those odds enormous sums of money have been laid upon him. It is obvious, therefore, that there were many people who had the strongest interest in preventing Silver Blaze from being there at the fall of the flag next Tuesday."

"This fact was, of course, appreciated at King's Pyland, where the colonel's training stable is situated. Every precaution was taken to guard the favorite. The trainer, John Straker, is a retired jockey who rode in Colonel Ross's colors before he became too heavy for the weighing-chair. He has served the colonel for five years as jockey and for seven as trainer, and has always shown himself to be a zealous and honest servant. Under him were three lads, for the establishment was a small one, containing only four horses in all. One of these lads sat up each night in the stable, while the others slept in the loft. All three bore excellent characters. John Straker, who is a married man, lived in a small villa about two hundred yards from the stables. He has no children, keeps one maid-servant, and is comfortably off. The country round is very lonely, but about half a mile to the north there is a small cluster of villas which have been built by a Tavistock contractor for the use of invalids and others who may wish to enjoy the pure Dartmoor air. Tavistock itself lies two miles to the west, while across the moor, also about two miles distant, is the larger training establishment of Mapleton, which belongs to Lord Backwater and is managed by Silas Brown. In every other direction the moor is a complete wilderness, inhabited only by a few roaming gypsies. Such was the general situation last Monday night when the catastrophe occurred.

"On that evening the horses had been exercised and watered as usual, and the stables were locked up at nine o'clock. Two of the lads walked up to the trainer's house, where they had supper in the kitchen, while the third, Ned Hunter, remained on guard. At a few minutes after nine the maid, Edith Baxter, carried down to the stables his supper, which consisted of a dish of curried mutton. She took no liquid, as there was a water-tap in the stables, and it was the rule that the lad on duty should drink nothing else. The maid carried a lantern with her, as it was very dark and the path ran across the open moor.

"Edith Baxter was within thirty yards of the stables when a man appeared out of the darkness and called to her to stop. As she stepped into the circle of yellow light thrown by the lantern she saw that he was a person of gentlemanly bearing, dressed in a gray suit of tweeds, with a cloth cap. He wore gaiters and carried a heavy stick with a knob to it. She was most impressed, however, by the extreme pallor of his face

and by the nervousness of his manner. His age, she thought, would be rather over thirty than under it.

"Can you tell me where I am?" he asked. "I had almost made up my mind to sleep on the moor when I saw the light of your lantern."



Curried mutton and Simpson: Toward a smoking-gun test.

"You are close to the King's Pyland training stables," said she.

"Oh, indeed! What a stroke of luck!" he cried. "I understand that a stable boy sleeps there alone every night. Perhaps that is his supper which you are carrying to him. Now I am sure that you would not be too proud to earn the price of a new dress, would you?" He took a piece of white paper folded up out of his waistcoat pocket. "See that the boy has this to-night, and you shall have the prettiest frock that money can buy."

"She was frightened by the earnestness of his manner and ran past him to the window through which she was accustomed to hand the meals. It was already opened, and Hunter was seated at the small table inside. She had begun to tell him of what had happened when the stranger came up again.

"Good-evening," said he, looking through the window. "I wanted to have a word with you." The girl has sworn that as he spoke she noticed the corner of the little paper packet protruding from his closed hand.

"What business have you here?" asked the lad.

"It's business that may put something into your pocket," said the other. "You've two horses in for the Wessex Cup—Silver Blaze and Bayard. Let me have the straight tip and you won't be a loser. Is it a fact that at the weights Bayard could give the other a hundred yards in five furlongs, and that the stable have put their money on him?"

"So, you're one of those damned touts!" cried the lad. "I'll show you how we serve them in King's Pyland." He sprang up and rushed across the stable to unloose the dog. The girl fled away to the house, but as she ran she looked back and saw that the stranger was leaning through the window. A minute later, however, when Hunter rushed out with the hound he was gone, and though he ran all round the buildings he failed to find any trace of him."

"One moment," I asked. "Did the stable boy, when he ran out with the dog, leave the door unlocked behind him?"

"Excellent, Watson, excellent!" murmured my companion. "The importance of the point struck me so forcibly that I sent a special wire to Dartmoor yesterday to clear the matter up. The boy locked the door before he left it. The window, I may add, was not large enough for a man to get through."

"Hunter waited until his fellow grooms had returned, when he sent a message to the trainer and told him what had occurred. Straker was excited at hearing the account, although he does not seem to have quite realized its true significance. It left him, however, vaguely uneasy, and Mrs. Straker, waking at one in the morning, found that he was dressing. In reply to her inquiries, he said that he could not sleep on account of his anxiety about the horses, and that he intended to walk down to the stables to see that all was well. She begged him to remain at home, as she could hear the rain pattering against the window, but in spite of her entreaties he pulled on his large mackintosh and left the house.

"Mrs. Straker awoke at seven in the morning to find that her husband had not yet returned. She dressed herself hastily, called the maid, and set off for the stables. The door was open; inside, huddled together

upon a chair, Hunter was sunk in a state of absolute stupor, the favorite's stall was empty, and there were no signs of his trainer.

"The two lads who slept in the chaff-cutting loft above the harness-room were quickly aroused. They had heard nothing during the night, for they are both sound sleepers. Hunter was obviously under the influence of some powerful drug, and as no sense could be got out of him, he was left to sleep it off while the two lads and the two women ran out in search of the absentees. They still had hopes that the trainer had for some reason taken out the horse for early exercise, but on ascending the knoll near the house, from which all the neighboring moors were visible, they not only could see no signs of the missing favorite, but they perceived something which warned them that they were in the presence of a tragedy.

"About a quarter of a mile from the stables John Straker's overcoat was flapping from a furze bush. Immediately beyond there was a bowl-shaped depression in the moor, and at the bottom of this was found the dead body of the unfortunate trainer. His head had been shattered by a savage blow from some heavy weapon, and he was wounded on the thigh, where there was a long, clean cut, inflicted evidently by some very sharp instrument. It was clear, however, that Straker had defended himself vigorously against his assailants, for in his right hand he held a small knife, which was clotted with blood up to the handle, while in his left he clasped a red and black silk cravat, which was recognized by the maid as having been worn on the preceding evening by the stranger who had visited the stables. Hunter, on recovering from his stupor, was also quite positive as to the ownership of the cravat. He was equally certain that the same stranger had, while standing at the window, drugged his curried mutton, and so deprived the stables of their watchman. As to the missing horse, there were abundant proofs in the mud which lay at the bottom of the fatal hollow that he had been there at the time of the struggle. But from that morning he has disappeared, and although a large reward has been offered, and all the gypsies of Dartmoor are on the alert, no news has come of him. Finally, an analysis has shown that the remains of his supper left by the stable lad contained an appreciable quantity of powdered opium, while the people at the house partook of the same dish on the same night without any ill effect.

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1 A person who obtains inside information on race horses and sells it to gamblers.

"Those are the main facts of the case, stripped of all surmise, and stated as baldly as possible. I shall now recapitulate what the police have done in the matter.

"Inspector Gregory, to whom the case has been committed, is an extremely competent officer. Were he but gifted with imagination he might rise to great heights in his profession. On his arrival he promptly found and arrested the man upon whom suspicion naturally rested. There was little difficulty in finding him, for he inhabited one of those villas which I have mentioned. His name, it appears, was Fitzroy Simpson. He was a man of excellent birth and education, who had squandered a fortune upon the turf, and who lived now by doing a little quiet and genteel book-making in the sporting clubs of London. An examination of his betting-book shows that bets to the amount of five thousand pounds had been registered by him against the favorite. On being arrested he volunteered the statement that he had come down to Dartmoor in the hope of getting some information about the King's Pyland horses, and also about Desborough, the second favorite, which was in charge of Silas Brown at the Mapleton stables. He did not attempt to deny that he had acted as described upon the evening before, but declared that he had no sinister designs and had simply wished to obtain first-hand information. When confronted with his cravat he turned very pale and was utterly unable to account for its presence in the hand of the murdered man. His wet clothing showed that he had been out in the storm of the night before, and his stick, which was a Penang lawyer weighted with lead, was just such a weapon as might, by repeated blows, have inflicted the terrible injuries to which the trainer had succumbed. On the other hand, there was no wound upon his person, while the state of Straker's knife would show that one at least of his assailants must bear his mark upon him. There you have it all in a nutshell, Watson, and if you can give me any light I shall be infinitely obliged to you."

I had listened with the greatest interest to the statement which Holmes, with characteristic clearness, had laid before me. Though most of the facts were familiar to me, I had not sufficiently appreciated their relative importance, nor their connection to each other.

"Is it not possible," I suggested, "that the incised wound upon Straker may have been caused by his

own knife in the convulsive struggles which follow any brain injury?"

"It is more than possible; it is probable," said Holmes. "In that case one of the main points in favor of the accused disappears."

"And yet," said I, "even now I fail to understand what the theory of the police can be."

"I am afraid that whatever theory we state has very grave objections to it," returned my companion. "The police imagine, I take it, that this Fitzroy Simpson, having drugged the lad, and having in some way obtained a duplicate key, opened the stable door and took out the horse, with the intention, apparently, of kidnapping him altogether. His bridle is missing, so that Simpson must have put this on. Then, having left the door open behind him, he was leading the horse away over the moor when he was either met or overtaken by the trainer. A row naturally ensued. Simpson beat out the trainer's brains with his heavy stick without receiving any injury from the small knife which Straker used in self-defence, and then the thief either led the horse on to some secret hiding-place, or else it may have bolted during the struggle, and be now wandering out on the moors. That is the case as it appears to the police, and improbable as it is, all other explanations are more improbable still. However, I shall very quickly test the matter when I am once upon the spot, and until then I cannot really see how we can get much further than our present position."

It was evening before we reached the little town of Tavistock, which lies, like the boss of a shield, in the middle of the huge circle of Dartmoor. Two gentlemen were awaiting us in the station—the one a tall, fair man with lion-like hair and beard and curiously penetrating light blue eyes; the other a small, alert person, very neat and dapper, in a frock-coat and gaiters, with trim little side-whiskers and an eyeglass. The latter was Colonel Ross, the well-known sportsman; the other, Inspector Gregory; a man who was rapidly making his name in the English detective service.

"I am delighted that you have come down, Mr. Holmes," said the colonel. "The inspector here has done all that could possibly be suggested, but I wish to leave no stone unturned in trying to avenge poor Straker and in recovering my horse."

"Have there been any fresh developments?" asked Holmes.

"I am sorry to say that we have made very little progress," said the inspector. "We have an open carriage outside, and as you would no doubt like to see the place before the light fails, we might talk it over as we drive."

A minute later we were all seated in a comfortable landau and were rattling through the quaint old Devonshire city. Inspector Gregory was full of his case and poured out a stream of remarks, while Holmes threw in an occasional question or interjection. Colonel Ross leaned back with his arms folded and his hat tilted over his eyes, while I listened with interest to the dialogue of the two detectives. Gregory was formulating his theory, which was almost exactly what Holmes had foretold in the train.

"The net is drawn pretty close round Fitzroy Simpson," he remarked, "and I believe myself that he is our man. At the same time I recognize that the evidence is purely circumstantial, and that some new development may upset it."

"How about Straker's knife?"

"We have quite come to the conclusion that he wounded himself in his fall."

"My friend Dr. Watson made that suggestion to me as we came down. If so, it would tell against this man Simpson."

"Undoubtedly. He has neither a knife nor any sign of a wound. The evidence against him is certainly very strong. He had a great interest in the disappearance of the favorite. He lies under suspicion of having poisoned the stable boy; he was undoubtedly out in the storm; he was armed with a heavy stick, and his cravat was found in the dead man's hand. I really think we have enough to go before a jury."

Holmes shook his head. "A clever counsel would tear it all to rags," said he. "Why should he take the horse out of the stable? If he wished to injure it, why could he not do it there? Has a duplicate key been found in his possession? What chemist sold him the powdered opium? Above all, where could he, a stranger to the district, hide a horse, and such a horse as this? What is his own explanation as to the paper which he wished the maid to give to the stable boy?"

"He says that it was a ten-pound note. One was found in his purse. But your other difficulties are not so formidable as they seem. He is not a stranger to the district. He has twice lodged at Tavistock in the summer. The opium was probably brought from London. The key, having served its purpose, would be hurled away. The horse may be at the bottom of one of the pits or old mines upon the moor."

"What does he say about the cravat?"

"He acknowledges that it is his and declares that he had lost it. But a new element has been introduced into the case which may account for his leading the horse from the stable."

Holmes pricked up his ears.

"We have found traces which show that a party of gypsies encamped on Monday night within a mile of the spot where the murder took place. On Tuesday they were gone. Now, presuming that there was some understanding between Simpson and these gypsies, might he not have been leading the horse to them when he was overtaken, and may they not have him now?"

"It is certainly possible."

"The moor is being scoured for these gypsies. I have also examined every stable and outhouse in Tavi-stock, and for a radius of ten miles."

"There is another training stable quite close, I understand?"

"Yes, and that is a factor which we must certainly not neglect. As Desborough, their horse, was second in the betting, they had an interest in the disappearance of the favorite. Silas Brown, the trainer, is known to have had large bets upon the event, and he was no friend to poor Straker. We have, however, examined the stables, and there is nothing to connect him with the affair."

"And nothing to connect this man Simpson with the interests of the Mapleton stables?"

"Nothing at all."

Holmes leaned back in the carriage, and the conversation ceased. A few minutes later our driver pulled up at a neat little red-brick villa with overhanging eaves which stood by the road. Some distance off, across a paddock, lay a long gray-tiled outbuilding. In every other direction the low curves of the moor, bronze-

coloured from the fading ferns, stretched away to the sky-line, broken only by the steeples of Tavistock, and by a cluster of houses away to the westward which marked the Mapleton stables. We all sprang out with the exception of Holmes, who continued to lean back with his eyes fixed upon the sky in front of him, entirely absorbed in his own thoughts. It was only when I touched his arm that he roused himself with a violent start and stepped out of the carriage.

"Excuse me," said he, turning to Colonel Ross, who had looked at him in some surprise. "I was day-dreaming." There was a gleam in his eyes and a suppressed excitement in his manner which convinced me, used as I was to his ways, that his hand was upon a clue, though I could not imagine where he had found it.

"Perhaps you would prefer at once to go on to the scene of the crime, Mr. Holmes?" said Gregory.

"I think that I should prefer to stay here a little and go into one or two questions of detail. Straker was brought back here, I presume?"

"Yes, he lies upstairs. The inquest is tomorrow."

"He has been in your service some years, Colonel Ross?"

"I have always found him an excellent servant."

"I presume that you made an inventory of what he had in his pockets at the time of his death, Inspector?"

"I have the things themselves in the sitting-room if you would care to see them."

"I should be very glad." We all filed into the front room and sat round the central table while the inspector unlocked a square tin box and laid a small heap of things before us. There was a box of vestas [i.e., matches], two inches of tallow candle, an A.D.P briar-root pipe, a pouch of sealskin with half an ounce of long-cut Cavendish, a silver watch with a gold chain, five sovereigns in gold, an aluminum pencil-case, a few papers, and an ivory-handled knife with a very delicate, inflexible blade marked Weiss & Co., London.

"This is a very singular knife," said Holmes, lifting it up and examining it minutely. "I presume, as I see blood-stains upon it, that it is the one which was

found in the dead man's grasp. Watson, this knife is surely in your line?"

"It is what we call a cataract knife," said I.

"I thought so. A very delicate blade devised for very delicate work. A strange thing for a man to carry with him upon a rough expedition, especially as it would not shut in his pocket."

"The tip was guarded by a disc of cork which we found beside his body," said the inspector. "His wife tells us that the knife had lain upon the dressing-table, and that he had picked it up as he left the room. It was a poor weapon, but perhaps the best that he could lay his hands on at the moment."

"Very possibly. How about these papers?"

"Three of them are receipted hay-dealers' accounts. One of them is a letter of instructions from Colonel Ross. This other is a milliner's<sup>2</sup> account for thirty-seven pounds fifteen made out by Madame Lesurier, of Bond Street, to William Derbyshire. Mrs. Straker tells us that Derbyshire was a friend of her husband's and that occasionally his letters were addressed here."

"Madame Derbyshire had somewhat expensive tastes," remarked Holmes, glancing down the account. "Twenty-two guineas is rather heavy for a single costume. However, there appears to be nothing more to learn, and we may now go down to the scene of the crime."

As we emerged from the sitting-room a woman, who had been waiting in the passage, took a step forward and laid her hand upon the inspector's sleeve. Her face was haggard and thin and eager, stamped with the print of a recent horror.

"Have you got them? Have you found them?" she panted.

"No, Mrs. Straker. But Mr. Holmes here has come from London to help us, and we shall do all that is possible."

"Surely I met you in Plymouth at a garden party some little time ago, Mrs. Straker?" said Holmes.

"No, sir; you are mistaken."

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2 A maker of woman's hats and clothing.



Holmes elicits a straw-in-the-wind test.

"Dear me! Why, I could have sworn to it. You wore a costume of dove-colored silk with ostrich-feather trimming."

"I never had such a dress, sir," answered the lady.

"Ah, that quite settles it," said Holmes. And with an apology he followed the inspector outside. A short walk across the moor took us to the hollow in which the body had been found. At the brink of it was the furze bush upon which the coat had been hung.

"There was no wind that night, I understand," said Holmes.

"None, but very heavy rain."

"In that case the overcoat was not blown against the furze bush, but placed there."

"Yes, it was laid across the bush."

"You fill me with interest. I perceive that the ground has been trampled up a good deal. No doubt many feet have been here since Monday night."

"A piece of matting has been laid here at the side, and we have all stood upon that."

"Excellent."

"In this bag I have one of the boots which Straker wore, one of Fitzroy Simpson's shoes, and a cast horseshoe of Silver Blaze."

"My dear Inspector, you surpass yourself!" Holmes took the bag, and, descending into the hollow, he pushed the matting into a more central position. Then stretching himself upon his face and leaning his chin upon his hands, he made a careful study of the trampled mud in front of him. "Hullo!" said he suddenly. "What's this?" It was a wax vesta, half burned, which was so coated with mud that it looked at first like a little chip of wood.

"I cannot think how I came to overlook it," said the inspector with an expression of annoyance.

"It was invisible, buried in the mud. I only saw it because I was looking for it."

"What! You expected to find it?"

"I thought it not unlikely."

He took the boots from the bag and compared the impressions of each of them with marks upon the ground. Then he clambered up to the rim of the hollow and crawled about among the ferns and bushes.

"I am afraid that there are no more tracks," said the inspector. "I have examined the ground very care-fully for a hundred yards in each direction."

"Indeed!" said Holmes, rising. "I should not have the impertinence to do it again after what you say. But I should like to take a little walk over the moor before it grows dark that I may know my ground to-morrow, and I think that I shall put this horseshoe into my pocket for luck."

Colonel Ross, who had shown some signs of impatience at my companion's quiet and systematic method of work, glanced at his watch. "I wish you would come back with me, Inspector," said he. "There are several points on which I should like your advice, and especially as to whether we do not owe it to the public to remove our horse's name from the entries for the cup."

"Certainly not," cried Holmes with decision. "I should let the name stand."

The colonel bowed. "I am very glad to have had your opinion, sir," said he. "You will find us at poor Straker's house when you have finished your walk, and we can drive together into Tavistock."

He turned back with the inspector, while Holmes and I walked slowly across the moor. The sun was beginning to sink behind the stable of Mapleton, and the long sloping plain in front of us was tinged with gold, deepening into rich, ruddy browns where the faded ferns and brambles caught the evening light. But the glories of the landscape were all wasted upon my companion, who was sunk in the deepest thought.

"It's this way, Watson," said he at last. "We may leave the question of who killed John Straker for the instant and confine ourselves to finding out what has become of the horse. Now, supposing that he broke away during or after the tragedy, where could he have gone to? The horse is a very gregarious creature. If left to himself his instincts would have been either to return to King's Pyland or go over to Mapleton. Why should he run wild upon the moor? He would surely have been seen by now. And why should gypsies kidnap him? These people always clear out when they hear of trouble, for they do not wish to be pestered by the police. They could not hope to sell such a horse. They would run a great risk and gain nothing by taking him. Surely that is clear."

"Where is he, then?"

"I have already said that he must have gone to King's Pyland or to Mapleton. He is not at King's Pyland. Therefore he is at Mapleton. Let us take that as a working hypothesis and see what it leads us to. This part of the moor, as the inspector remarked, is very hard and dry. But it falls away towards Mapleton, and you can see from here that there is a long hollow over yonder, which must have been very wet on Monday night. If our supposition is correct, then the horse must have crossed that, and there is the point where we should look for his tracks."

We had been walking briskly during this conversation, and a few more minutes brought us to the hollow in question. At Holmes's request I walked down the bank to the right, and he to the left, but I had not taken fifty paces before I heard him give a shout and saw him waving his hand to me. The track of a horse was plainly outlined in the soft earth in front of him, and the shoe which he took from his pocket exactly fitted the impression.

"See the value of imagination," said Holmes. "It is the one quality which Gregory lacks. We imagined what

might have happened, acted upon the supposition, and find ourselves justified. Let us proceed."

We crossed the marshy bottom and passed over a quarter of a mile of dry, hard turf. Again the ground sloped, and again we came on the tracks. Then we lost them for half a mile, but only to pick them up once more quite close to Mapleton. It was Holmes who saw them first, and he stood pointing with a look of triumph upon his face. A man's track was visible beside the horse's.

"The horse was alone before," I cried.

"Quite so. It was alone before. Hullo, what is this?"

The double track turned sharp off and took the direction of King's Pyland. Holmes whistled, and we both followed along after it. His eyes were on the trail, but I happened to look a little to one side and saw to my surprise the same tracks coming back again in the opposite direction.

"One for you, Watson," said Holmes when I pointed it out. "You have saved us a long walk, which would have brought us back on our own traces. Let us follow the return track."

We had not to go far. It ended at the paving of asphalt which led up to the gates of the Mapleton stables. As we approached, a groom ran out from them.

"We don't want any loiterers about here," said he.

"I only wished to ask a question," said Holmes, with his finger and thumb in his waistcoat pocket. "Should I be too early to see your master, Mr. Silas Brown, if I were to call at five o'clock to-morrow morning?"

"Bless you, sir, if anyone is about he will be, for he is always the first stirring. But here he is, sir, to answer your questions for himself. No, sir, no, it is as much as my place is worth to let him see me touch your money. Afterwards, if you like."

As Sherlock Holmes replaced the half-crown which he had drawn from his pocket, a fierce-looking elderly man strode out from the gate with a hunting crop swinging in his hand.

"What's this, Dawson!" he cried. "No gossiping! Go about your business! And you, what the devil do you want here?"



Holmes and Watson find Silver Blaze, based on straw-in-the-wind and hoop tests, plus the method of residues.

"Ten minutes' talk with you, my good sir," said Holmes in the sweetest of voices.

"I've no time to talk to every gadabout. We want no strangers here. Be off, or you may find a dog at your heels."

Holmes leaned forward and whispered something in the trainer's ear. He started violently and flushed to the temples.

"It's a lie!" he shouted. "An infernal lie!"

"Very good. Shall we argue about it here in public or talk it over in your parlor?"

"Oh, come in if you wish to."

Holmes smiled. "I shall not keep you more than a few minutes, Watson," said he. "Now, Mr. Brown, I am quite at your disposal."

It was twenty minutes, and the reds had all faded into grays before Holmes and the trainer reappeared. Never have I seen such a change as had been brought about in Silas Brown in that short time. His face was ashy pale, beads of perspiration shone upon his brow, and his hands shook until the hunting-crop wagged like a branch in the wind. His bullying, overbearing

manner was all gone too, and he cringed along at my companion's side like a dog with its master.

"Your instructions will be done. It shall all be done," said he.

"There must be no mistake," said Holmes, looking round at him. The other winced as he read the menace in his eyes.

"Oh, no, there shall be no mistake. It shall be there. Should I change it first or not?"

Holmes thought a little and then burst out laughing. "No, don't," said he, "I shall write to you about it. No tricks, now, or—"

"Oh, you can trust me, you can trust me!"

"Yes, I think I can. Well, you shall hear from me tomorrow." He turned upon his heel, disregarding the trembling hand which the other held out to him, and we set off for King's Pyland.

"A more perfect compound of the bully, coward, and sneak than Master Silas Brown I have seldom met with," remarked Holmes as we trudged along together.

"He has the horse, then?"

"He tried to bluster out of it, but I described to him so exactly what his actions had been upon that morning that he is convinced that I was watching him. Of course you observed the peculiarly square toes in the impressions, and that his own boots exactly corresponded to them. Again, of course no subordinate would have dared to do such a thing. I described to him how, when according to his custom he was the first down, he perceived a strange horse wandering over the moor. How he went out to it, and his astonishment at recognizing, from the white fore-head which has given the favorite its name, that chance had put in his power the only horse which could beat the one upon which he had put his money. Then I described how his first impulse had been to lead him back to King's Pyland, and how the devil had shown him how he could hide the horse until the race was over, and how he had led it back and concealed it at Mapleton. When I told him every detail he gave it up and thought only of saving his own skin."

"But his stables had been searched?"

"Oh, an old horse-faker like him has many a dodge."

"But are you not afraid to leave the horse in his power now since he has every interest in injuring it?"

"My dear fellow, he will guard it as the apple of his eye. He knows that his only hope of mercy is to produce it safe."

"Colonel Ross did not impress me as a man who would be likely to show much mercy in any case."

"The matter does not rest with Colonel Ross. I follow my own methods and tell as much or as little as I choose. That is the advantage of being unofficial. I don't know whether you observed it, Watson, but the colonel's manner has been just a trifle cavalier to me. I am inclined now to have a little amusement at his expense. Say nothing to him about the horse."

"Certainly not without your permission."

"And of course this is all quite a minor point compared to the question of who killed John Straker."

"And you will devote yourself to that?"

"On the contrary, we both go back to London by the night train."

I was thunderstruck by my friend's words. We had only been a few hours in Devonshire, and that he should give up an investigation which he had begun so brilliantly was quite incomprehensible to me. Not a word more could I draw from him until we were back at the trainer's house. The colonel and the inspector were awaiting us in the parlor

"My friend and I return to town by the night-express," said Holmes. "We have had a charming little breath of your beautiful Dartmoor air."

The inspector opened his eyes, and the colonel's lip curled in a sneer.

"So you despair of arresting the murderer of poor Straker," said he.

Holmes shrugged his shoulders. "There are certainly grave difficulties in the way," said he. "I have every hope, however, that your horse will start upon Tuesday, and I beg that you will have your jockey in readiness. Might I ask for a photograph of Mr. John Straker?"

The inspector took one from an envelope and handed it to him.

"My dear Gregory, you anticipate all my wants. If I might ask you to wait here for an instant, I have a question which I should like to put to the maid."

"I must say that I am rather disappointed in our London consultant," said Colonel Ross bluntly as my friend left the room. "I do not see that we are any further than when he came."

"At least you have his assurance that your horse will run," said I.

"Yes, I have his assurance," said the colonel with a shrug of his shoulders. "I should prefer to have the horse."

I was about to make some reply in defense of my friend when he entered the room again.

"Now, gentlemen," said he, "I am quite ready for Tavistock."

As we stepped into the carriage one of the stable lads held the door open for us. A sudden idea seemed to occur to Holmes, for he leaned forward and touched the lad upon the sleeve.

"You have a few sheep in the paddock," he said. "Who attends to them?"

"I do, sir."

"Have you noticed anything amiss with them of late?"

"Well, sir, not of much account, but three of them have gone lame, sir."



Information from the stable boy about the lame sheep yields an auxiliary outcome test.

I could see that Holmes was extremely pleased, for he chuckled and rubbed his hands together.

"A long shot, Watson, a very long shot," said he, pinching my arm. "Gregory, let me recommend to your attention this singular epidemic among the sheep. Drive on, coachman!"

Colonel Ross still wore an expression which showed the poor opinion which he had formed of my companion's ability, but I saw by the inspector's face that his attention had been keenly aroused.

"You consider that to be important?" he asked.

"Exceedingly so."

"Is there any point to which you would wish to draw my attention?"

"To the curious incident of the dog in the night-time."

"The dog did nothing in the night-time."

"That was the curious incident," remarked Sherlock Holmes.

Four days later Holmes and I were again in the train, bound for Winchester to see the race for the Wessex Cup. Colonel Ross met us by appointment outside the station, and we drove in his drag to the course beyond the town. His face was grave, and his manner was cold in the extreme.

"I have seen nothing of my horse," said he.

"I suppose that you would know him when you saw him?" asked Holmes.

The colonel was very angry. "I have been on the turf for twenty years and never was asked such a question as that before," said he. "A child would know Silver Blaze with his white forehead and his mottled off-foreleg."

"How is the betting?"

"Well, that is the curious part of it. You could have got fifteen to one yesterday, but the price has become shorter and shorter, until you can hardly get three to one now."

"Hum!" said Holmes. "Somebody knows something, that is clear."

As the drag drew up in the enclosure near the grandstand I glanced at the card to see the entries.

Wessex Plate [it ran] 50 sovs. each h ft with 1000 sovs. added, for four and five year olds. Second, £300. Third, £200. New course (one mile and five furlongs).

1. Mr. Heath Newton's Nero. Red cap. Cinnamon jacket.
2. Colonel Wardlaw's Pugilist. Pink cap. Blue and black jacket.
3. Lord Backwater's Desborough. Yellow cap and sleeves.
4. Colonel Ross's Silver Blaze. Black cap. Red jacket.
5. Duke of Balmoral's Iris. Yellow and black stripes.
6. Lord Singleford's Rasper. Purple cap. Black sleeves.

"We scratched our other one and put all hopes on your word," said the colonel. "Why, what is that? Silver Blaze favorite?"

"Five to four against Silver Blaze!" roared the ring. "Five to four against Silver Blaze! Five to fifteen against Desborough! Five to four on the field!"

"There are the numbers up," I cried. "They are all six there."

"All six there? Then my horse is running," cried the colonel in great agitation. "But I don't see him. My colors have not passed."

"Only five have passed. This must be he."

As I spoke a powerful bay horse swept out from the weighing enclosure and cantered past us, bearing on its back the well-known black and red of the colonel.

"That's not my horse," cried the owner. "That beast has not a white hair upon its body. What is this that you have done, Mr. Holmes?"

"Well, well, let us see how he gets on," said my friend imperturbably. For a few minutes he gazed through my field-glass. "Capital! An excellent start!" he cried suddenly. "There they are, coming round the curve!"

From our drag we had a superb view as they came up the straight. The six horses were so close together that a carpet could have covered them, but halfway up the yellow of the Mapleton stable showed to the front. Before they reached us, however, Des-borough's bolt was shot, and the colonel's horse, coming away with a rush, passed the post a good six lengths before its rival, the Duke of Balmoral's Iris making a bad third.

"It's my race, anyhow," gasped the colonel, passing his hand over his eyes. "I confess that I can make neither head nor tail of it. Don't you think that you have kept up your mystery long enough, Mr. Holmes?"

"Certainly, Colonel, you shall know everything. Let us all go round and have a look at the horse together. Here he is," he continued as we made our way into the weighing enclosure, where only owners and their friends find admittance. "You have only to wash his face and his leg in spirits of wine, and you will find that he is the same old Silver Blaze as ever."

"You take my breath away!"

"I found him in the hands of a faker and took the liberty of running him just as he was sent over."

"My dear sir, you have done wonders. The horse looks very fit and well. It never went better in its life. I owe you a thousand apologies for having doubted your ability. You have done me a great service by recovering my horse. You would do me a greater still if you could lay your hands on the murderer of John Straker."

"I have done so," said Holmes quietly.

The colonel and I stared at him in amazement. "You have got him! Where is he, then?"

"He is here."

"Here! Where?"

"In my company at the present moment."

The colonel flushed angrily. "I quite recognize that I am under obligations to you, Mr. Holmes," said he, "but I must regard what you have just said as either a very bad joke or an insult."

Sherlock Holmes laughed. "I assure you that I have not associated you with the crime, Colonel," said he. "The real murderer is standing immediately behind you." He stepped past and laid his hand upon the glossy neck of the thoroughbred.



Holmes reveals his inference about the real murderer, based on a doubly-decisive test.

"The horse!" cried both the colonel and myself.

"Yes, the horse. And it may lessen his guilt if I say that it was done in self-defense, and that John Straker was a man who was entirely unworthy of your confidence. But there goes the bell, and as I stand to win a little on this next race, I shall defer a lengthy explanation until a more fitting time."

We had the corner of a Pullman car to ourselves that evening as we whirled back to London, and I fancy that the journey was a short one to Colonel Ross as well as to myself as we listened to our companion's narrative of the events which had occurred at the Dartmoor training stables upon that Monday night, and the means by which he had unravelled them.

"I confess," said he, "that any theories which I had formed from the newspaper accounts were entirely erroneous. And yet there were indications there, had they not been overlaid by other details, which concealed their true import. I went to Devonshire with the conviction that Fitzroy Simpson was the true culprit,

although, of course, I saw that the evidence against him was by no means complete. It was while I was in the carriage, just as we reached the trainer's house, that the immense significance of the curried mutton occurred to me. You may remember that I was distract and remained sitting after you had all alighted. I was marveling in my own mind how I could possibly have overlooked so obvious a clue."

"I confess," said the colonel, "that even now I cannot see how it helps us."

"It was the first link in my chain of reasoning. Powdered opium is by no means tasteless. The flavor is not disagreeable, but it is perceptible. Were it mixed with any ordinary dish the eater would undoubtedly detect it and would probably eat no more. A curry was exactly the medium which would disguise this taste. By no possible supposition could this stranger, Fitzroy Simpson, have caused curry to be served in the trainer's family that night, and it is surely too monstrous a coincidence to suppose that he happened to come along with powdered opium upon the very night when a dish happened to be served which would disguise the flavor. That is unthinkable. Therefore Simpson becomes eliminated from the case, and our attention centers upon Straker and his wife, the only two people who could have chosen curried mutton for supper that night. The opium was added after the dish was set aside for the stable boy, for the others had the same for supper with no ill effects. Which of them, then, had access to that dish without the maid seeing them?

"Before deciding that question I had grasped the significance of the silence of the dog, for one true inference invariably suggests others. The Simpson incident had shown me that a dog was kept in the stables, and yet, though someone had been in and had fetched out a horse, he had not barked enough to arouse the two lads in the loft. Obviously the midnight visitor was someone whom the dog knew well.

"I was already convinced, or almost convinced, that John Straker went down to the stables in the dead of the night and took out Silver Blaze. For what purpose? For a dishonest one, obviously, or why should he drug his own stable boy? And yet I was at a loss to know why. There have been cases before now where trainers have made sure of great sums of money by laying against their own horses through

agents and then preventing them from winning by fraud. Sometimes it is a pulling jockey. Sometimes it is some surer and subtler means. What was it here? I hoped that the contents of his pockets might help me to form a conclusion.

"And they did so. You cannot have forgotten the singular knife which was found in the dead man's hand, a knife which certainly no sane man would choose for a weapon. It was, as Dr. Watson told us, a form of knife which is used for the most delicate operations known in surgery. And it was to be used for a delicate operation that night. You must know, with your wide experience of turf matters, Colonel Ross, that it is possible to make a slight nick upon the tendons of a horse's ham, and to do it subcutaneously, so as to leave absolutely no trace. A horse so treated would develop a slight lameness, which would be put down to a strain in exercise or a touch of rheumatism, but never to foul play."

"Villain! Scoundrel!" cried the colonel.

"We have here the explanation of why John Straker wished to take the horse out on to the moor. So spirited a creature would have certainly roused the soundest of sleepers when it felt the prick of the knife. It was absolutely necessary to do it in the open air."

"I have been blind!" cried the colonel. "Of course that was why he needed the candle and struck the match."

"Undoubtedly. But in examining his belongings I was fortunate enough to discover not only the method of the crime but even its motives. As a man of the world, Colonel, you know that men do not carry other people's bills about in their pockets. We have most of us quite enough to do to settle our own. I at once concluded that Straker was leading a double life and keeping a second establishment. The nature of the bill showed that there was a lady in the case, and one who had expensive tastes. Liberal as you are with your servants, one can hardly expect that they can buy twenty-guinea walking dresses for their ladies. I questioned Mrs. Straker as to the dress without her knowing it, and, having satisfied myself that it had never reached her, I made a note of the milliner's address and felt that by calling there with Straker's photograph I could easily dispose of the mythical Derbyshire.

"From that time on all was plain. Straker had led out the horse to a hollow where his light would be invisible. Simpson in his flight had dropped his cravat,

and Straker had picked it up—with some idea, perhaps, that he might use it in securing the horse's leg. Once in the hollow, he had got behind the horse and had struck a light; but the creature, frightened at the sudden glare, and with the strange instinct of animals feeling that some mischief was intended, had lashed out, and the steel shoe had struck Straker full on the forehead. He had already, in spite of the rain, taken off his overcoat in order to do his delicate task, and so, as he fell, his knife gashed his thigh. Do I make it clear?"

"Wonderful!" cried the colonel. "Wonderful! You might have been there!"

"My final shot was, I confess, a very long one. It struck me that so astute a man as Straker would not undertake this delicate tendon-nicking without a little practice. What could he practice on? My eyes fell upon the sheep, and I asked a question which, rather to my surprise, showed that my surmise was correct.

"When I returned to London I called upon the milliner, who had recognized Straker as an excellent customer of the name of Derbyshire, who had a very dashing wife with a strong partiality for expensive dresses. I have no doubt that this woman had plunged him over head and ears in debt, and so led him into this miserable plot."

"You have explained all but one thing," cried the colonel. "Where was the horse?"

"Ah, it bolted. and was cared for by one of your neighbors. We must have an amnesty in that direction, I think. This is Clapham Junction, if I am not mistaken, and we shall be in Victoria in less than ten minutes. If you care to smoke a cigar in our rooms, Colonel, I shall be happy to give you any other details which might interest you."