11 Process Tracing and Narrative Science

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Abstract
Process tracing is a familiar analytical tool in a number of sciences. Successful process tracing pulls together what is already known, believed or assumed and the various events, activities and entities in a case study in order to construct a narrative of the case. Several chapters in this volume offer accounts of narrative science that are explored through process tracing. These examples are analysed to reveal how various aspects of process tracing inform narrative and how narrative, in turn, aids process tracing in an iterative process of interpretation and reinterpretation of evidence, testing, development and revision of hypotheses, and the explanation of singular events.

11.1 Introduction

'Process tracing' is used in theorizing about, testing for and identifying causal mechanisms operating within a case. A number of chapters in this volume are concerned with such questions of causality, and deal with them through analysing the process through which some particular outcome occurred; and the accounts that they offer of the role of narrative are similar to the patterns of reasoning that are used in process tracing. For this reason, I have read them with process tracing in mind and I offer my reflections on that exercise.

My interest in how narrative and process tracing are related stems from exploring how case studies have been used in political science. Political science case studies are detailed investigations of some particular event, time period, region or country. A case study includes many different types of information – interviews, archives, journalistic accounts and other data (both quantitative and qualitative). Researchers typically organize and present this information in a narrative form. Some of the goals of case study research are explaining and understanding the occurrence of some particular event, testing a hypothesis about how an event came about and discovering similarities among this and other events that might allow for generalization. I have argued elsewhere that the narrative presentation of case studies is not coincidental to these goals, but rather aids in achieving them (Crasnow 2017). Narrative does this by giving the

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interconnections among the various entities, activities and events detailed in the case, indicating how some events are contingent on others. Narrative pulls together disparate evidence into a coherent whole. Thus the narrative through which a case is presented contributes to understanding the case, to seeing various aspects of it as evidence for causal claims, and our understanding of how the case is both different from and similar to other cases. In these ways, narrative contributes to the production of knowledge.

I begin this account of the relation of process tracing to narrative knowledge with an explanation of process tracing as practised in political science and then connect the method more directly to narrative through an analogy with the reasoning involved in solving a mystery. This is an analogy that appears frequently in the political science methodological literature. I next sketch an example of process tracing in political science, using it to illustrate the way that evidence is identified and used to support a claim that particular causal mechanisms are operating and how they shape the narrative of the case. I then turn to some examples chosen from the chapters in this volume. I begin with the historical sciences – specifically with geology – but I do not confine myself to those disciplines as a number of other chapters contain ideas about narrative science that are relevant to process tracing as well. I close with some thoughts on what might be learned from this exploration and a suggestion for further inquiry.

11.2 Process Tracing in Political Science

In political science, because a case study is primarily undertaken to investigate causality, the interconnections among the various aspects of the case are causal and the primary thread of the narrative is given through hypothesized causal mechanisms. Process tracing is tracing the workings of those mechanisms through identifying evidence that the mechanisms were operating. The mechanisms make sense of how the various aspects of the case fit together and so provide the overarching narrative ordering of the case.

Political methodologists Derek Beach and Rasmus Brun Pedersen offer the following account of process tracing: 'Process-tracing is a research method for tracing causal mechanisms using detailed, within-case empirical analysis of how a causal mechanism operated in real-world cases' (Beach and Pedersen 2019: 1). Beach and Pedersen clarify that a mechanism is not to be identified with the starting point or any of the intervening stages of the process. Mechanisms are not themselves causes, but rather are triggered by causes (Beach and Pedersen 2019: 3). In other words, they emphasize the dynamic nature of mechanisms together with the idea that process tracing is not a matter of picking out one or a few features that are connected causally, but rather of tracing a process from its inception to its conclusion, both showing how it operated in this case and identifying the evidence that it did so.

The question of how to think of mechanisms is not fully agreed upon among social scientists or philosophers of science, but there is enough overlap in accounts to support a characterization that captures features that are generally agreed on (Machamer, Darden and Craver 2000; Glennan 2002; Tabery 2004; Bogen 2005; Reiss 2008; Illari and Williamson 2012). Such an account of causal mechanism is as follows: mechanisms have parts – these parts may be identified as activities, events or entities, but are in some sense discrete (if only analytically); the parts are organized in some way – a mechanism has a structure; and there is an active element that constitutes the inter-relationship of the parts – all characterizations of mechanisms include the idea that an effect is brought about, produced, propagated or maintained through the inter-relationship of the parts (Crasnow 2017: 8).

The mechanisms relevant to political science accounts are psychological, social and political. Process tracing analytically unpacks mechanisms allowing the researcher to seek evidence that the component parts of any particular mechanism are present and operating in the case. The mechanism is the means through which these parts are understood as part of the same process. Acknowledging the integrative nature of causal mechanisms involves recognizing that process tracing is not just a matter of collecting evidence of the parts through the examination of the case but involves finding evidence that the various parts are connected to each other as well, that is, indicating how they are parts of the whole (the mechanism), which is more than the collection of its parts.

When process tracing is focused on examining the operation of a mechanism in a specific case, it may be probative or exploratory – does the proposed mechanism provide a plausible account of the case? If the answer is yes, then further investigation of how that mechanism operates in the case is warranted. Or it may be that the case is investigated as a means of testing the hypothesized mechanism for this case. In such circumstances, the success of the test is a way of garnering support for the hypothesized mechanism as the best (or better) explanation of the case. If the test fails, the failure motivates a search for alternative accounts – other mechanisms that are consistent with the observed traces. These may be other known mechanisms or may suggest new hypotheses. In this way process tracing informs theory development. The case might also be investigated to see why a mechanism that was expected to operate failed in this particular context – in which case, process tracing might suggest the limits of theory or motivate theory revision. Similarities of this case to other cases in which known mechanisms operate may suggest new candidates for consideration in this case. In addition, when researchers are confident of their account they may seek other similar cases in which the mechanism operates.

In order to seek traces of a process, some sense of what that process might be – for processes that are causal mechanisms, what mechanism might be

operating – already has to be on the table. It might be only vaguely sketched out, to be filled in later should it prove promising, or it may already be well-developed theoretically and investigated elsewhere. The hypothesis serves to guide the researcher towards the appropriate sorts of intervening factors expected to be present if that mechanism was indeed operating. These are the entities, activities and events that are elements of the causal mechanism or indicators of its operation (recognized as indicators because of other things that are known or believed). Process tracing is undertaken to see if these elements are present. When theorizing (developing a hypothesis), the various elements of the case may be seen to resemble elements of other known mechanisms, suggesting that the same or a similar mechanism may be operating in this case. Alternatively, expectations produced by such similarities may be overthrown motivating a search for differences that suggest alternative causal hypotheses. Finally, which activities, entities or events are relevant to the case – what the boundaries of the case are and what the case should be understood as a case of – depend in part on how they fit the hypothesized causal mechanism and what the outcome of the mechanism is understood to be, which, in turn, depends on the research question that guides the investigation of the case.

11.3 Solving Mysteries

Political methodologists often use the analogy of a detective story to illustrate how process tracing works. The elements of the detective's case are the traces of the mechanism that process tracing is seeking. They are like clues of the sort that a detective might pick out in trying to solve a murder mystery. In classic murder mysteries, the murder itself has not been directly observed but there are clues (traces) that suggest what happened and who was responsible. As the detective finds out about the movements of the suspects, a timeline is constructed that suggests certain hypotheses about what might have happened and ultimately who among the suspects is guilty. The detective might start with standard hypotheses suggested by a body of knowledge about crimes of this type. For example, it is known that most victims are killed by those close to them or that often the person who discovers the body is the murderer. These hypotheses can be tested against what is discovered in the case as the detective follows various implications of the hypothesis together with what is known and makes predictions about what other traces might be found that would be consistent or inconsistent with that hypothesis.

Information about the psychology of the subjects – specifically about their relationships with each other and their possible motivations – is put together with the timeline. As these elements are pulled together, they further shape hypotheses and so the study of the case supports both the development and testing of those hypotheses. These hypotheses are hypotheses about who

committed the crime, but that determination also depends on knowing how and why it was done. Identifying the culprit requires pulling together a variety of evidence on means, motive and opportunity.

Each of these lines of investigation might be pursued separately. If a suspect has an alibi for the time of the murder this is a clue that counts against her being the murderer – she did not have the opportunity. If a will is discovered that provides a motive, this may suggest a new suspect. If the murder weapon is found, this provides evidence of the means. Each of these aspects of the crime has its own traces (clues that are relevant to who, how and why), but the overarching account of the production of the outcome requires putting these all together.

I am belabouring this analogy for several reasons. First, it is an analogy that appears repeatedly in the political science literature on process tracing (e.g., 'The Adventure of Silver Blaze' is used by Beach and Pedersen in the appendix of their 2019 book). Second, and relatedly, it illustrates how process tracing supports the various different goals of case study research previously mentioned: explaining and understanding a particular event, testing a hypothesis about how an event came about and seeking similarities and difference with known cases (although the goal is to solve *this* murder, it is not unlikely that something more general about murders might emerge from the investigation). Third, it suggests that process tracing is an iterative process. Proposed hypotheses are discarded or revised in response to discovered clues (traces of the process through which the murder was accomplished). Reinterpretation of evidence may occur when new information comes to light (perhaps the alibi is found out to be a lie after more careful investigation). The mystery story analogy shows how a narrative works not only to suggest hypotheses and test them, but also how working back and forth between hypothesis and evidence to pull together a *backstory* (Beatty, Chapter 20) is often part of what is required to understand how and why something happened. When new information becomes available, old evidence may need reinterpretation in order to achieve a coherent whole – an account of who did the murder, in what way, and why.

Process tracing – the tracing of the causal mechanism that connects an initial causal factor with an outcome of interest – functions as an important analytical tool for identifying and organizing evidence in an iterative process and not only as a tool for testing hypotheses. Process tracing involves the interplay of what we already know, believe or assume, the hypotheses we are considering (suggested by what we know believe or assume) and the various traces (events, activities and entities) in the case that are seen as evidence when brought into relation with the hypothesis. Consequently, the traces only become evidence relative to some particular hypothesis and against the background of other knowledge, beliefs and assumptions. The integrative and iterative nature of process tracing provides one way of constructing a narrative of the case.

11.4 An Example from Political Science

Elisabeth Wood (2003) investigates the civil war in El Salvador in order to solve what she takes to be a puzzle about the case: why was there broad participation in the insurgency even though the costs of participation were so high and the rewards so minimal? Most alternative explanations postulate particular ways in which insurgents are motivated by expected gains (or avoiding higher costs). She argues that such accounts do not adequately track the pattern of participation in El Salvador. 'The relevant literature on revolutions, collective action, and social movements provide some guidance but not adequate answers to the puzzle of high-risk collective action in the Salvadoran context' (Wood 2003: 10). Participation, while broad, was not universal. Only about a third of the poor, rural class (*campesinos*) participated in the insurgency – a large enough rate of participation to have significant effect, but standard hypotheses, such as Marxist accounts of class struggle, do not square with the large number of 'free riders'. In addition, the level of participation is puzzling given the high level of risk and the minimal reward.

To answer her research question, Wood looks more closely at the difference between those who participated (approximately one-third of the rural poor) and those who did not. Her primary evidence is extensive interviews (more than 200) over multiple years both during and after the civil war. Using this information, together with details about the timing of particular events during the civil war, when they happened in relationship to other events, and the varying levels of participation, she concludes that three psychological mechanisms were responsible for collective action in El Salvador. She calls the first 'participation' a term that she defines more precisely than mere involvement in the insurgency. Participation in this sense is the desire to be involved in activities that reflect moral commitment. She identifies the influence of Liberation Theology on *campesinos* as fuelling this motivation. The second is 'defiance'. The government response to strikes was believed by many *campesinos* to be an overreaction to legitimate means of protest for unfair working conditions (strikes and peaceful demonstrations). This perception fuelled and justified defiance as a motivator of collective action. The third is what she calls 'pleasure in agency'. Participants reported a pride and sense of authorship in having been involved in making history.

Wood traces the operation of each of these mechanisms through patterns of responses to her interview questions, together with specific documented instances of collective action and government response that occurred through the decade of civil war. For example, the repressive government response to strikes increased the perceived risk of participation (and so further maximized the cost and for relatively small benefit) and yet resulted in increased participation in the insurgency. Interview responses indicate that the repressive efforts

of the government were perceived as unjustified and met with outrage and defiance.[1]

Her book-length case study provides an account of the civil war through these and other mechanisms, incorporating particular events and shifts in strategy in response to such events (increased repression on the part of the regime resulting in a shift from political mobilization to armed insurgency). Fundamentally, the argument is that the narrative of the case told through the psychological (emotional and moral) mechanisms that Wood identifies provides a better account than alternatives.[2] The traces or clues to the importance of the emotional and moral factors are primarily in the results of her interviews.[3] These responses yielded recurring themes: injustice of pre-war land distribution; desire for land; the contempt with which they had been treated; brutality of the government responses to non-violent strikes and demonstrations; fear during the war; suffering of their families; post-war assertion of political and social equality; authorship of changes; and pride in participation (Wood 2003: 18).

While I only sketch Wood's argument here, it is worth noting several ways in which process tracing is operating. There is, first of all, the tracing of evidence that the psychological mechanisms that she postulates were operating. She notes these in both their appearance in interviews with those who were participants in the insurgency and their absence in those interviews with those who were not. Additionally, responses appear to appeal to these mechanisms as motivations for action, revealing causal connections.

While her goal is to explain the case through the operation of these mechanisms (to explain a singular case), she is also using the case to develop hypotheses. We can see this particularly well in her development of the notion of pleasure in agency which results from an interpretation of a number of themes in interviews. She is also engaging in theory revision or augmentation since she does not entirely reject material explanations in the literature on insurgency and collective action but does find them inadequate. Finally, she is also making use of background knowledge against which she identifies the puzzle that she wants to address but also through which she recognizes as evidence particular events that occur in her case – for example, the escalation of insurgent activity in the wake of violent

[1] And putting them together brings about 'narrative closure'. See Hajek's introduction, Chapter 2.

[2] Wood does not reject the idea that other mechanisms were operating but only that without making reference to the emotional and moral features that emerge out of her interviews the accounts are limited. Most importantly, they do not make sense of the differences between those who participated and those did not, whereas her account accommodates the two-thirds non-participation.

[3] For example, she had volunteers from one of her study areas participate in a map-drawing workshop where they produced maps of the farmlands in their area showing use of the land before and after the civil war.

government repression following strikes and peaceful protests in the early 1980s. Escalation of resistance is one of the known responses to repression. Finally, Wood offers a coherent narrative of the civil war in El Salvador that solves the puzzle that she originally saw in the case.

These are some of the ways that process tracing works in political science.[4] Do we see something like this elsewhere in the sciences? Are there ways that narrative functions elsewhere in the sciences that might help understand how narrative and process tracing function together better? I turn to the chapters of this volume with these questions in mind.

11.5 Tracing A Singular Event: The Rupture Process of the Tohoku Earthquake

I begin with Teru Miyake's analysis of research on the 2011 Tohoku earthquake, in Chapter 5, that I think bears the greatest similarity to the example of Wood's use of process tracing. He opens his chapter with what he describes as a narrative of the 'rupture process' of this particular earthquake. As he notes, each earthquake has its unique rupture process – much as each insurgency has its own trajectory.

The rupture process of this quake (as with all quakes) is a complex sequence of interconnected events. Calling it a process indicates that it is more than a chronology of events. We can see from the paragraph that begins Miyake's chapter that this sequence is one in which the events are causally connected. The origin of the Tohoku earthquake is a 'wide megathrust fault' that ruptures at 'a frictionally locked region in the central portion' of the fault. The description of the fault (wide megathrust fault) carries causal implications, as does the information that this region of the fault was frictionally locked. The descriptions are dynamic. This initial rupture 'failed to arrest', 'continuing to expand for 150 s, spreading over the full width of the boundary and along its length for 400 km' (Miyake, Chapter 5, quoting Lay 2018: 4–5). This description is not just what happens next but how it is connected to what went before and, because the expansion is described as continuing, what happens after the initial rupture. As the account continues, the events are sequenced and positioned in causal relation to each other through terms that would be familiar to geologists as having causal import. This sequencing is supported by a variety of evidence, which we can think of as traces of the earthquake. The various stages identified in the paragraph that summarizes the rupture process appear to be components of the specific mechanism that accounts for *this* earthquake.

These rupture processes cannot be directly observed but are reconstructed from 'traces' – among them seismographic data, permanent shifts in the earth's

[4] Another example from political science appears in Crasnow (2017).

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surface and data from tsunamis. While Miyake notes that the lack of direct observation of the fault is one of the factors that makes it difficult to reconstruct the rupture process and to study earthquakes more generally, this sort of problem is far from unique to earthquakes, as we have seen in the previous discussion. Miyake's account of how these difficulties are tackled – how these traces are recovered and become evidence for the rupture process – involves narrative in two ways that he identifies.[5] The first involves determining how to treat the seismographic data as reliable evidence. One way this is accomplished is through a technique relied upon in the discipline (slip inversion) and its use to inform source models. Determining reliability is accomplished through what Miyake calls earthquake '*rupture narratives*'.

While I do not want to discuss these narratives in terms of process tracing, it is worth pointing out that this example illustrates how data does not directly speak as evidence but comes to be understood as evidence through its relationship to other background beliefs, assumptions and knowledge. There is a similarity here with Wood's account in that she takes one chapter of her book to discuss her methods – most particularly the use of interviews. These interviews involved the interviewees recalling events from the past and hence their use as evidence depends on knowledge, beliefs and assumptions about how memory functions. Wood argues, for example, that memories of particular types of events – 'those that rank as highly intense (in a variety of cognitive and biological measures) tend to be better remembered' (Wood 2003: 33).

The second type of narrative that Miyake discusses – 'integrating narrative' – displays a number of the characteristics of iteration and integration that I have focused on in the discussion of process tracing in section 11.4. In Miyake's account, integrating narratives pull together a variety of seismological information including evidence (data that appears to be most stable) from source models, but also what is known about the movement of the earth, data from tsunamis, information about the history of the fault (past earthquakes) and seismic events immediately preceding the earthquake. Integrating narratives of the 2011 Tohoku earthquake are revised and adjusted as new information becomes available or is reinterpreted.

Miyake works through examples of how the introduction of new techniques and data produced results that were in conflict with slip inversion results. These conflicts are tackled through understanding what each additional technique and data set reveals and reconciling the accounts by adjusting the integrating narrative to reflect the new understanding. As Miyake points out, this, in turn, raises new questions – specifically whether the particular process that

[5] Miyake also identified 'research narratives', which I do not discuss, but which are related to Meunier's distinction (Chapter 12) between a 'research narrative' and a 'narrative of nature', recounting what happened.

gave rise to this data is unique to this particular rupture or is due to features of the fault (and hence relevant to future ruptures). When traces do not fit current understanding (as in the case of Wood's consideration of available explanations for collective action and insurgency), this lack of fit motivates new research questions. The drive to integrate the data into a coherent whole – to show how the events are initiated and proceed through various stages to a particular outcome – is disrupted by what does not fit and calls for a new or revised account. Miyake notes that such events raise open questions to be addressed through the iterative process of creating an integrating narrative. It directs researchers in their search for further evidence – evidence that either the event is unique or that it is based in characteristics of the fault. What counts as evidence will depend on what else is known (about the fault, about the geology of the region more generally, as well as geological theory); some of what is learned from the Tohoku earthquake may alter what is believed to be known and thus change how other traces are interpreted.

In the typical political science case, the search for traces is guided by the hypothesized mechanism (although, as we have seen in the Wood example, that mechanism is often complex). In the case of the earthquake, the mechanism is also highly complex. While the data speak primarily to the component parts of this complex process, the goal is to put these parts together into a whole – to narrate the rupture process of this earthquake.

11.6 Testing a Hypothesis

In another example (Chapter 4), Andrew Hopkins gives an account of the search for an explanation of a rock formation in north-west Scotland – the Stac Fada Member. In section 11.5, I focused on process tracing as tracing the operation of causal mechanisms in a particular case, but process tracing also serves as a means of testing hypotheses. Often these two modes of inquiry are intertwined. We see that in this chapter, where several different hypotheses are considered as explanations for a singular event – the formation of the Stac Fada Member.

Hopkins's account discusses the understanding of the geology of a particular region of Scotland in the nineteenth century. At that time, the proposed causal mechanism through which the geology was explained was based on an analogy with the contemporary sedimentary formation on the Sinai Peninsula. This hypothesis is proposed because of the similarities between that present-day activity and the formation as it was known at the time. The source of this hypothesis in the observation of contemporary geological events highlights that what are considered relevant or 'live' hypotheses depends in part of the state of both our empirical and theoretical knowledge at the relevant point in time. Background knowledge, beliefs and assumptions shape the narrative ordering

of events and the understanding of what counts as evidence for their explanation.

The discovery of the Stac Fada Member in the 1960s called for explanation. Its discovery disrupted expectations since the mechanism that accounted for the surrounding region was not consistent with this formation. Among the traces that did not fit were 'angular shards of pumice, green particles of devitrified glass and accretionary lapilli' (Hopkins, Chapter 4) observed in this newly discovered formation. The Stac Fada exhibited features that appeared to be consistent with a volcanic hypothesis (although there were some aspects that raised questions – for example, the lack of a volcanic vent and the unusual absence of other volcanic activity in the area). Also disconcerting was evidence in the formation of an 'abrupt change' shifting land from east to west. If we think of process tracing as fitting evidence to the hypothesis, anomalies like this that do not fit into the narrative told through the hypothesis are problematic. They call for explanation and so pose new research questions. Or, if the other things that were known, believed or assumed at the time indicate why they may be discounted as irrelevant, they may be put aside. In this case, for example, it is known that erosion and burial over the long period of geologic times can eliminate or hide relevant evidence like a volcanic vent. The 'abrupt shift' is harder to account for, however, and thus challenges expectations and opens space for consideration of an alternative hypothesis. Other factors in what hypotheses might be considered were, as Hopkins notes, the prevalence of uniformitarianism – the methodological assumption that the processes that should be appealed to when offering geological explanations should only include those that are currently observable – and the seeming 'outrageous' nature of proposing extraterrestrial causes. The proposed hypotheses – in the nineteenth century prior to the discovery of the Stac Fada and after its discovery in the 1960s – reflect this constraint in that they rely on similarities between processes in regions contemporaneously observed and the region under investigation.

It is not until the early 2000s that Ken Amor proposed an alternative based on his comparison of the traces in the Stac Fada Member with traces he was familiar with from his study of a meteor crater in Bavaria. He first notes the devitrified glass, which suggested a similar cause since he had observed such traces previously in Bavaria. While such similarities cannot establish any hypothesis, they offer the opportunity to seek other traces of the proposed causal mechanism. When Amor took a sample specifically to look for such traces, he found shocked quartz in the sample – also consistent with his hypothesis. The fit of these traces with his hypothesis guides further research and informs a sketch of an account of what happened.

In this example, process tracing is used as a means of hypothesis testing and development – the lack of fit throws doubt on the viability of the hypothesis and

motivates a consideration of alternatives. When a hypothesis fits with traces, it continues to be a live possibility; if it does not fit, and anomalies cannot be accounted for, it may cease to be viable.

In addition, the comparison of cases suggests hypotheses through the identification of similarities between cases – first for the geology of the region prior to the discovery of the Stac Fada Member (the similarity to the Sinai Peninsula) and then after the discovery of the formation (similarity to meteor crater). Also of interest is the role of the uniformitarian framework, dominant during the early part of this period, which appears to have constrained the set of viable hypotheses, as Hopkins points out. The meteorite hypothesis only emerges as a real possibility when the traces of such an event had been observed elsewhere, uniformitarianism has loosened its grip and an extraterrestrial explanation becomes a live option, as Hopkins notes. The abrupt shift of land from east to west is no longer an anomaly but now relevant since it can be understood as a trace of the meteor impact but not of the volcanic hypothesis. Telling the history of the geology of the region through the meteor hypothesis thus offers a more coherent account than the volcanic hypothesis. Although the site of the impact crater cannot be identified, this is not thought to be problematic for the same reasons that the missing volcanic vent is not considered an issue – erosion and burial can make such evidence inaccessible over time.

Hopkins describes the consideration of alternative hypotheses in terms of reinterpretation of evidence, but what is noteworthy is that the reinterpretation results from what the various bits of evidence are understood to be traces of – that is, how they are made relevant through the hypothesis and background knowledge. The hypothesis and what else we know come together with the events, activities and entities found in the case to make a more coherent account of the geology of the region. If there are traces that do not fit, that may leave open the possible consideration of a new hypotheses *if* they are deemed relevant given what else is known. It could be, of course, that more than one hypothesis provides a causal mechanism consistent with the details of the case. In Hopkins's account, we find out that shocked quartz could also be caused by a lightning strike. But can the lightning strike hypothesis fit the abrupt change that shifted land from east to west into an integrated whole?

11.7 Narrative as a Tool for Process Tracing; Process Tracing as a Tool for Narrative

Both these examples illustrate the iterative and integrative nature of how process tracing informs the construction of a scientific narrative by working back and forth between theory, evidence and background knowledge, beliefs and assumptions. In fact, although I have treated them as illustrative of different modes of process tracing, they also indicate how these modes are not mutually

exclusive but in fact complement each other in the research process. These various stages of process tracing both aid in the goal of constructing a narrative of the case (offering a response to the research question) and are informed by that goal.

A number of other chapters recount incidents in science that can be understood as engaging with aspects of reasoning involved in process tracing. For example, Elizabeth Haines (Chapter 9) describes Hugh Hamshaw Thomas as working in two disciplinary realms. His understanding in each of these realms is informed by what is taken to be true at the time in each and the questions that arise for those contexts. His understanding of the fossils that he finds – traces that he argues indicate a missing link species between ferns and flowering plants – is determined by the need to fit the narrative into an overarching evolutionary narrative. In the realm of aerial photography, how to interpret what is photographed requires some hypotheses about what features are relevant – which can be understood in relation to others given that particular hypothesized activities could take place there. Ideas about what such activities would involve are needed both to suggest and to limit the possible interpretations of the aerial photographs. For the former, the theoretical framework (evolutionary theory) aids in determining which traces are potentially significant. For the latter, consider Haines's recounting of Gombrich's comments about the photographic interpreter who is useless because he has too much imagination. He sees too many features as potentially significant. The theoretical framework is necessary to constrain what sorts of connections can be made.

Such constraints are not always positive, however. Englemann's examination of plague narratives (Chapter 14) offers an illustration of how the fixation on soil as a cause of plague limited understanding of the disease. In this case, false beliefs and assumptions lead to a focus on traces consistent with a hypothesized mechanism that turns out to be wrong. Relevant traces are not recognized as relevant because the search is based on flawed, probably racist, background beliefs. An incomplete examination of traces may not turn up evidence that challenges the hypothesis and alters the conception of how the case should be viewed and what counts as evidence. Noticing the importance of what may be anomalous traces – things that do not fit the narrative a particular hypothesis offers – can bring about what Hurwitz refers to as 'epistemic switches' in his chapter discussing anecdotes (Chapter 17).

For Hurwitz, in the context of medical knowledge, an important feature of anecdotes is how they allow for the reframing of information so that it can become evidence. In the example of the Bouvart anecdote about the Marquis, greetings are reframed as part of the diagnostic context and so become evidence, whereas the prevailing conceptions of evidence had previously deemed them irrelevant. Something like this also occurs in the case of Viagra, when the

angina research project reaches a dead end and a new framework for research is suggested through anecdote. The expectation that ordinary interactions are irrelevant to diagnosis, the expectation that only what is relevant to the treatment of angina is of interest, are shifted. In each of these cases, the anecdote itself does not give us an overarching story – does not reveal the causal mechanism – but switches awareness of what is already in front of researchers, altering its significance. The research that follows is what establishes the medical claims that are later made, but Hurwitz makes the strong assertion that, without anecdote, treatments and cures might never be found. Without dislodging negatively constraining prior beliefs and assumptions new ones are not possible.

The way background knowledge, beliefs and assumptions constrain what hypotheses are open to consideration and its close connection to what counts as evidence is also illustrated in Bhattacharayya's chapter (Chapter 8). She notes that reconstructing shipwrecks plays a crucial role in establishing legal responsibility for the disasters. But, to fit the events together, some sense of what the plausible causal connections are through which the fitting can be done must already be at hand. Think, for example, of Beatty's discussion of the explanation of the location of the eyes on flatfishes (Chapter 20). Evolutionary theory both constrains and suggests the plausible connections shaping the narrative. Bhattacharayya's discussion of two legal cases offers some clue to what sorts of ways of fitting these events together were considered live possibilities. The two sorts of evidence thought relevant in these cases were evidence about the character of the actors (particularly the various shipmasters involved) and evidence related to the storm itself. In the case of character, past performance, behaviour after the shipwreck, history of drinking and other features thought related to character come into play. These are treated as evidence of failure to behave adequately under the specific circumstances of the storm. Piddington's work argues for preferencing a narrative of how the storm might be expected to unfold and the appropriateness of the response of the shipmaster given that expectation. The storm cards function as a way of shifting the standard of evidence to expectations about how shipmaster and crew ought to behave given how the course of the storm was thought likely to progress.

11.8 Conclusion

I began by noting how process tracing works to support the construction of narrative in political science case studies. I next explored some of the examples of narrative science in this volume with process tracing in mind. What stands out is the various ways that process tracing calls for the use of theory, background beliefs and assumptions to identify and make use of relevant elements of the case in order to construct a coherent and complete narrative. Process

tracing thus functions as a tool for colligating all of these features into a narrative in the sense that Mary Morgan describes (2017; and Chapter 1). Part of process tracing involves identifying what it is that should count as traces – making the case that particular elements count as evidence, or, put another way, that they should be part of the narrative. Wood does this when she offers research about memory to support her use of interview data as evidence of the psychological mechanisms that she claims are operating. Miyake's source model narratives function in a similar way. Process tracing pulls together disparate sorts of evidence produced through a variety of methods and integrates them into a unified account. It does this through theorizing about those connections and working back and forth between theory and the elements of the case in an iterative fashion until a satisfactory account can be constructed. Given that process tracing must start from connections that we know, believe or assume, it carries with it the danger of falsely limiting our understanding so that evidence is not recognized as such. However, because the method is iterative, process tracing also allows for reinterpretation through epistemic shifts.

I close with a final thought about process tracing and narrative that suggests an area of further investigation. Process tracing connects the particular with the general through the use of theory and causal mechanism as means of structuring narrative. How features of a case or, more generally, data are to be interpreted as evidence depends on other things that we know, believe or assume, not only about this case but about others. And what we hope to take away from the case is knowledge that will be useful in other locations as well. The interplay of the particular and the general, something crucial for knowledge of the empirical world, strikes me as an important feature of narrative and why it has such fundamental appeal to human beings.[6]

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[6] *Narrative Science* book: This project has received funding from the European Research Council under the European Union's Horizon 2020 research and innovation programme (grant agreement No. 694732). www.narrative-science.org/.

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