



## New Political Economy


ISSN: 1356-3467 (Print) 1469-9923 (Online) Journal homepage: <http://www.tandfonline.com/loi/cnpe20>

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To cite this article: Christine Trampusch & Bruno Palier (2016): Between X and Y: how process tracing contributes to opening the black box of causality, *New Political Economy*, DOI: [10.1080/13563467.2015.1134465](https://doi.org/10.1080/13563467.2015.1134465)

To link to this article: <http://dx.doi.org/10.1080/13563467.2015.1134465>

 Published online: 22 Feb 2016.

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# Between X and Y: how process tracing contributes to opening the black box of causality

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## ABSTRACT

This article maps the methodological debate on process tracing and discusses the diverse variants of process tracing in order to highlight the commonalities beyond diversity and disagreements. Today most authors agree that process tracing is aimed at unpacking causal and temporal mechanisms. The article distinguishes two main types of use for process tracing. Some are more inductive, aimed at theory building (i.e. at uncovering and specifying causal mechanisms) while others are more deductive, aimed at theory testing (and refining). The paper summarizes the main added value and drawbacks of process tracing. It ends by providing ten guidelines for when and how to apply process tracing.

## ARTICLE HISTORY

Received 16 November 2014  
Accepted 17 December 2015

## KEYWORDS

Process tracing; method;  
methodology; ontology;  
causality

## 1. Introduction

In recent years the process tracing method has become increasingly popular in case studies as well as in political science and political economy methodological debates (Hall 2003, 2013; Waldner 2012: 66).<sup>1</sup> The goal of this special issue is to more fully explore its implications for political economy. To facilitate this dialogue, this introductory essay begins with a brief overview of the increasingly diverse and multifaceted literature on process tracing. In the second section, it extrapolates on the implications for political economy research, details the different possible uses of process tracing, underlines the advantages of and challenges met by this method, and concludes by proposing 10 guidelines for better implementing process tracing in actual research.

## 2. Overview

Process tracing was originally employed in cognitive and psychological studies on individual decision-making (for an overview, see: Ford *et al.* 1989; Falleti, in this symposium). A second process-oriented strand of literature evolved in organisational studies where Mohr (1982) introduced the distinction between variance and process research in the analysis of organisational change in order to clarify the ontological differences between methods that analyse time in terms of variables (such as a time series analysis) and those that investigate the dynamic essence of processes by investigating sequences (named as case studies) (Van de Ven and Pool 2005).<sup>2</sup>

In 1979 the political scientist Alexander L. George was the first scholar (Bennett and Checkel 2015: 5) to propose using process tracing in his discipline. He suggested applying 'the historian's methodology of explanation' to 'assess whether a statistical correlation between independent variables and the dependent variable is of causal significance' (George 1979a: 46). He writes:

[T]he investigator subjects a single case in which that correlation appears to more intensive scrutiny, as the historian would do, in order to establish whether there exists an *intervening process*, that is, a causal nexus, between the independent and the dependent variable. (George 1979a: 46)

George (1979b: 113) and George and McKeown (1985: 35; italics added) put forward the “‘process-tracing’ procedure’ as an ‘attempt to trace the process – the intervening steps – by which beliefs influence behaviour’ and as a means to make ‘historical arguments about causal processes in studies of human *and* organizational decision-making’. In particular, international political economy and international relations scholars – and later those in comparative political economy – have followed this advice, applying process tracing to explain how individual and collective decision-making processes work by uncovering the stimuli of decision-making and the ‘effects of various institutional arrangements on attention, processing, and behaviour’ (George and McKeown 1985: 35) (see also Falletti’s contribution to this symposium).

Since then, and particularly in the last few years, a large body of further important contributions on process tracing has been published and no end to this process is in sight (for example, George and Bennett 2005, Gerring 2007: Ch. 7, Bennett 2008, Hall 2008, 2013, Blatter and Collier 2010, 2011, Mahoney 2010, 2012, Haverland 2012, Mahoney and Goertz 2012: Ch. 8, Rohlfing 2012: Ch. 6, Waldner 2012, Beach and Pedersen 2013, Bennett and Checkel 2015). Among other aspects, the recent literature primarily discusses variations of the method, best practices, how to use this method to increase the validity of causal inference, and its possible integration into multi-method research (MMR) design. The broadened focus of this recent literature has also led to a proliferation of conceptions about what process tracing should be, which has distanced process tracing more and more from what George (1979b: 113) and George and McKeown (1985: 35) defined as the ‘process-tracing procedure’.

This widened focus of the literature has led to a confused state of affairs, even to ‘methodological stretching’.<sup>3</sup> The main reason is that most of this literature is mainly methodologically oriented, and discusses very abstract notions and philosophical assumptions, including different methodologies of process tracing such as Bayesian process tracing, set theoretic process tracing or process tracing with directed acyclic graphs (Bennett and Checkel 2015: 16).<sup>4</sup> Although some of these new contributions are potentially important, many of them become more and more distanced from real research.

Definitions of process tracing have multiplied rather than simplified over time. The process tracing method has been ‘stretched’ and applied to nearly every analysis of processes. Looking at the variety of definitions and types of process tracing, summarised in Table 1 and 2 (see also Tulia Falletti’s contribution), we would characterise the current situation as one of internal debate, considerable disagreement, and occasional confusion. With this symposium, we aim to clarify the situation. We do this by showing what the various approaches to process tracing have in common, by demonstrating the added value and challenges of using process tracing in political science and political economy research, and by illustrating how and when this method can be usefully applied.

In this article, we map the methodological debate on process tracing and discuss the diverse variants of process tracing in order to highlight what appear to be commonalities disguised by diversity and disagreements. While – over time – we count 18 different definitions of process tracing (see Table 1) and no less than 18 types of process tracing suggested in the methodological literature (see Table 2), 4 main lessons can be drawn from the current debate.

First, today most authors agree that process tracing is about causal and temporal mechanisms: it is a method for unpacking causality, that aims at studying what happens between X and Y and beyond (scope conditions). As Bennett and Checkel (2015: 9) put it ‘process tracing is a key technique for capturing causal mechanisms in action’. Process tracing methods allow for systematic and rigorous qualitative analysis that can *complement the correlational approach* in the analysis of causation. This definition is very similar to that offered by Alexander L. George (1979a, 1979b), who first introduced process tracing to political science.

It is important to note that the explanatory aspirations of process tracers differ from those of scholars applying multivariate statistical methods (Hall 2008: 305–6). Multivariate statisticians *quantify* the

average causal effects that causal factors (independent variables) have on an outcome (dependent variable) and assume that average effects of these factors can be isolated across cases. Process tracers do not seek precise estimates of specific causes but rather intend to specify the ‘process whereby relevant variables have an effect’ within individual cases (Hall 2008: 306). Their goal is to observe causal process through close-up qualitative analysis within single cases, rather than to statistically estimate their effects across multiple cases. They consider the analysis of causal effects to include both the investigation of the effects of causes and the study of causal chains, causal mechanisms and the causes of effects.<sup>5</sup> They are more sensitive to the context in which causal processes unfold, thus interested in knowing about the temporal and spatial scope conditions of mechanisms and their underpinning theories (Falleti and Lynch 2009: 1152).

Second, despite the agreement on analysing causal mechanisms, the literature varies on the specifics of causal process tracing. We identify at least three different ways of implementing causal process tracing. One way focuses on the (causal or temporal) sequences of events. It takes ‘time seriously’ and considers it as part of the causal explanation, hence relies on detailed tracing of processes. It does so by disentangling (temporal) complexities such as causal pathways and feedback processes (for example, Büthe 2002, Falleti and Mahoney 2015, Falleti in this symposium). A second way concentrates on identifying and testing hypotheses on causal mechanisms which open the black box of causal inference (for example, Rohlfing 2012, Beach and Pedersen 2013, Beach in this symposium). A third take on process tracing focuses on background factors such as omitted variables, the problem of endogeneity or on scope conditions (Kreuzer in this symposium). In order to map and discuss these different approaches to the analysis of causal mechanisms we have invited three distinguished ‘process tracers’ to develop their own approach on how to identify and study causal mechanisms.

The third lesson is that in the application of process tracing to the analysis of causal mechanisms and in its use as a *means of causal inference*, we come across *two ontologies*: a deterministic and a probabilistic conception of causality. The deterministic conception implies that process tracing analyses the link between X and Y and is interested in what ‘is constant in a mechanism’ (Mayntz 2004: 245). In our symposium, Beach follows this conception as he views process tracing as a method to test theories about causal mechanisms, defined as a theoretical system. He follows a set-theoretical conception of causal mechanisms. In contrast, the probabilistic perspective includes scope conditions as well as the outcome in the mechanism analysis and, therewith, does not assume that the same mechanism always produces the same outcome since mechanisms vary in their operation. Mayntz (2004: 244; italics by Mayntz) calls this a ‘*generative mechanism*’. In their contributions, Tulia Falleti and Marcus Kreuzer allow for probabilism. We return later to these two ontologies.

Fourth, the literature differs in its approach to theory. Some contributions are more inductive, aimed at theory building (that is, at uncovering and specifying causal mechanisms) while others are more deductive, aimed at theory testing (and refining) (that is, at checking with empirical case(s) analysis whether the theoretically elaborated causal mechanisms are indeed the ones explaining how X and Y are connected) (see also George and Bennett 2005). We view this differentiation between inductive and deductive approaches as important for two reasons. First, it makes process tracing the only case study approach within political economy capable of testing as well as developing theory. Second, it builds an indispensable bridge to quantitative approaches and is therefore crucial for MMR design, even though, as we will show later, some have reservations about the compatibility of process tracing with multi-method approaches to causality. In this symposium, Derek Beach outlines the strengths and uses of process tracing in more deductively oriented research while Tulia Falleti advocates for its more inductive use. In her suggestion of ‘Theory Guided Process Tracing’ (TGPT), Falleti presents her own view on theory building use of process tracing and how it helps to uncover causal mechanisms within what she calls ‘intensive process’ tracing, a variant that contributes to theory building.<sup>6</sup> Marcus Kreuzer’s version of Bayesian process tracing

tries to integrate theory building and theory testing aspects. It emphasises the importance of ‘reviewing, evaluating and incorporating existing foreknowledge in the causal inference process’.

Based on the preceding literature overview, we now move to develop four main points that are of key importance for the development of process tracing in political economy. First, we emphasise that causal process tracing is indispensable for clarifying causal as well as temporal processes. Second, we elaborate on the two main uses of process tracing, the more inductive and the more deductive ones. In this context we underline that currently the Bayesian version of process tracing is the most standardised variant regarding causal inference statements. It can also integrate the inductive and deductive goals of process tracing. Third, we discuss the strength and weakness of the causal process tracing in order to clarify when this time-consuming research method is and is not worth pursuing. Finally, we address the discussion on best practices and process tracing standards (for example, Beach and Pedersen 2013, Bennett and Checkel 2015, Waldner 2015) and we suggest ten steps for good process tracing.

### 3. Process tracing is aimed at analysing causal mechanisms

There are many different definitions of what process tracing actually is. Waldner rightly highlights that process tracing has become an ‘umbrella term’ (Waldner 2012: 67). Bennett and Checkel (2015: 2) even speak of an existing ‘buzzword problem’. Table 1 presents the evolution of the major definitions of process tracing, which range from describing it as a method for analysing decision-making processes (George 1979a, 1979b, George and McKeown 1985: 35) and investigating ‘diagnostic pieces of evidence’ (Collier 2010: 2), to depicting it as a means to identify intervening causal processes (George and Bennett 2005: 206) and as a method that yields alternative explanations of a case that may even be applicable to the wider phenomenon the case represents (Bennett 2008: 4).

**Table 1.** Definitions of process tracing (in chronological order).

‘As its name implies, this procedure [process tracing] is intended to investigate and explain the decision process by which various initial conditions are translated into outcomes ... The process tracing approach attempts to uncover what stimuli the actors attend to; the decision process that makes use of these stimuli to arrive at decisions; the actual behavior that then occurs; the effect of various institutional arrangements on attention, processing, and behavior; and the effect of other variables of interest on attention, processing and behavior’ (George and McKeown 1985: 35).

‘Process tracing approaches such as verbal protocol analysis and information board methodologies have been developed to study the cognitive processes underlying decision making’ (Ford *et al.* 1989: abstract). ‘Process models attempt to focus more directly on the intervening steps that occur between the introduction of informational inputs and the decision outcomes’ (Ford *et al.* 1989: 75).

Process tracing ‘links theory and empirical work by using the observable implications of a theory to suggest new observations that should be made to evaluate the theory’ (King *et al.* 1994: 227). Finding ‘plausible hypotheses about causal mechanisms’ (King *et al.* 1994: 228), but not useful for making strong causal inferences ‘because more than one mechanism can be activated’ (King *et al.* 1994: 228).

‘These sorts of inquiries constitute the method of ‘process tracing’. The researcher examines specific conjunctions of factors and outcomes, and attempts to draw causal analysis and inference in these particular cases. And in most cases we can understand this approach as an effort to uncover the microfoundations of the phenomenon in question’ (Little 1995: 45).

‘Process tracing tests theories using observations within cases’ (Van Evera 1997: 56).

‘The process tracing method attempts to identify the intervening causal process – the causal chain and causal mechanism – between an independent variable (or variables) and the outcome of the dependent variable’ (George and Bennett 2005: 206). ‘Process-tracing provides a common middle ground for historians interested in historical explanation and political scientists and other social scientist who are sensitive to the complexities of historical events but are more interested in theorizing about categories of cases as well as explaining individual cases’ (George and Bennett 2005: 223).

‘The application of process tracing usually means to trace the operation of the causal mechanism(s) at work in a given situation. One carefully maps the expectations about the workings of the mechanism’ (Checkel 2005: 6).

‘The significant benefit of process tracing is that, if done properly it places theory and data in close proximity. One quickly comes to see what works and – equally important – what does not. This learning process goes on at various levels – methodological, theoretical and meta-theoretical’ (Checkel 2005: 22).

(Continued)

**Table 1.** Continued.

'Rather than multiple instances of  $X1 \rightarrow Y$  (the large-N cross-case style of research), one examines a single instance of  $X1 \rightarrow X2 \rightarrow X3 \rightarrow X4 \rightarrow Y$ . (...) In these respects, process tracing is akin to detective work' (Gerring 2007: 173).

'A style of analysis used to reconstruct a causal process that has occurred within a single case ... Its defining features are that (a) multiple types of evidence (non comparable observations) are employed for the verification of a single outcome and (b) the causal process itself is usually quite complex, involving a long causal chain and perhaps multiple switches, feedback loops, and the like' (Gerring 2007: 216).

'Process tracing can involve both inductive and deductive study of events and sequences within a case. Inductive examination may reveal potentially causal processes that the researcher had not theorized a priori. Deductively, theories can suggest which intervening events should have occurred within a case if the theory is an accurate explanation of the case. Depending on the theory under investigation, some of the hypothesized steps in the case may be tightly defined necessary conditions, and others may be defined more loosely as having several substitutable processes that could have taken place at a particular juncture' (Bennett and Elman 2007: 183).

'Process tracing involves looking at evidence within an individual case, or a temporally and spatially bound instance of a specified phenomenon, to derive and/or test alternative explanations of that case. In other words, process tracing seeks an *historical explanation* of an individual case, and this explanation may or may not provide a theoretical explanation relevant to the wider phenomenon of which the case is an instance' (Bennett 2008: 4).

'Process tracing can be used as a method for evaluating hypotheses about the causes of a specific outcome in a particular case. It is arguably the most important tool of causal inference in qualitative and case study research (George and Bennett 2005, Collier *et al.* 2010). The tests associated with process tracing can help a researcher establish that: (1) a specific event or process took place, (2) a different event or process occurred after the initial event or process, and (3) the former was a cause of the latter' (Mahoney 2012: 2).

Rohlfing (2012: ch. 6) argues that process tracing helps to analyse two different types of processes, realized and anticipated processes.

'Process tracing evidently involves processes, mechanisms, and heterogeneous evidence. It will not be easy to subsume these considerations in a single definition (...) I define process tracing as mode of causal inference based on concatenation, not covariation. Process tracing uses a longitudinal research design whose data consist of a sequence of events (individual and collective acts or changes of a state) represented by nonstandardized observations drawn from a single unit of analysis ... By relying on within-case analysis, process tracing privileges internal validity over external validity; in return for his constraint on generality, process tracing has the potential to generate relatively complete explanations' (Waldner 2012: 67–8).

'The essence of process-tracing research is that scholars want to go beyond merely identifying correlations between independent variables (Xs) and outcomes (Ys)' (Beach and Pedersen 2013: 1). '... process tracing methods are arguably the only method that allows us to study causal mechanisms' (Beach and Pedersen 2013: 1–2).

'The idea of process tracing is to identify and cut down the "causal chain" that connects independent and dependent variables and to examine each sequence in detail' (Maggetti *et al.* 2012: 59).

'... techniques falling under the label of process tracing are particularly well-suited for measuring and testing hypothesized causal mechanisms' (Bennett and Checkel 2015: 1–2).

'... process tracing may help to validate design and modelling assumptions in natural experiments: through the discovery of what I have called treatment-assignment CPOs and the testing of model-validation CPOs' (Dunning 2015: 214).

'... process tracing is especially valuable for establishing the features of the events that compose individual sequences (e.g. their duration, order, and pace) as well as the causal mechanisms that link them together. There is no substitute for process tracing when analyzing the events that make up the sequences and processes that are studied in comparative-historical research' (Falleti and Mahoney 2015: 212).

Source: Own compilation.

The above table shows that while process tracing was originally defined as a method to analyse decision-making processes, now it is predominantly defined as a method aiming to identify or test hypotheses on causal mechanisms in order to compensate for weaknesses in correlational analysis. The method is even sometimes viewed as the 'only method' (Beach and Pedersen 2013: 1–2) for solving the mechanism problem of causation that has vexed generations of social scientists and that statistical and experimental methods are less able to tackle. As Tulia Falleti makes clear in her contribution, over time, process tracing has been expanded: from being a method to analyse decision-making processes at the individual level and the micro-foundations of behaviour, to a method of scrutinising mechanisms that may also operate beyond the individual level to analyse macro-level causal mechanisms (similar: Bennett and Checkel 2015: 11).



Process tracers take the term ‘process’ seriously. They analyse ‘causal-process observations’ (Collier *et al.* 2004: 277, Mahoney 2010), that is, ‘an insight or piece of data that provides information about context, process, or mechanism, and that contributes distinctive leverage in causal inference’ (Collier *et al.* 2004: 277). From this also follows that process tracers seek to address some weaknesses of statistical analyses (for example, Bennett and George 1997, Checkel 2005, George and Bennett 2005, Schimmelfennig 2006, Blatter *et al.* 2007: 157–70). They compensate for and solve the problems that correlational studies have with specifying causality, its type and direction. Process tracers find it impossible to analyse processes without qualitative data, hence, they use primary sources such as documents and interviews, as well as secondary literature describing the specific outcome.<sup>7</sup> Process tracing also helps solve the problems of selectivity, omitted variable bias and spurious causation (Mahoney 2004: 89).

Researchers using process tracing want to understand what links causal factors, events, sequences and outcomes together. In our symposium, Derek Beach emphasises that (from a set-theoretical perspective) researchers want to identify the ‘cogs and wheels’ of causal mechanisms, while Tulia Falleti shows that the analysis of ‘temporal sequences’ of events is also important because the order of events is ‘causally consequential’. Marcus Kreuzer adds to this debate that process tracers ‘emphasize the importance of opening up black boxes, investigating the functioning of unstated causal mechanisms, probing for endogeneity or confounders, and exploring underlying ontological assumptions’.

Today, all process tracers seek to identify or specify causal and temporal mechanisms. This can be done in two ways: when we are interested in making causal sequential or temporal sequential arguments through a close analysis of sequences and temporal orders of events (for example, Falleti and Mahoney 2015; Falleti in this symposium)<sup>8</sup>; and, when we are seeking to ‘flesh out the causal process between X and Y’ by opening the black box of causal inference (see Beach in this symposium).

But what are causal mechanisms? While Derek Beach provides in his contribution a very specific answer to this question, Mahoney (2001: 579–80) lists no less than 24 definitions of causal mechanisms used in social science literature, either focusing on causal chains, or causal paths, or intervening variables, and so on. It is far beyond this introductory note to elaborate on these different 24 variants of causal mechanisms.<sup>9</sup> What matters here is that, beyond the diverse conceptions of causal mechanisms, process tracers share the desire to rest causal inferences not just on the cross-case based correlation between independent and dependent variables, but also on within case observation of the actual causal processes.

In the current debate, we find two ontologies of causal mechanisms. On the one hand, some assume a deterministic conception of causal mechanisms, while, on the other hand, other scholars support a probabilistic understanding of causality (see also Bennett and Checkel 2015: 10–11). Whereas determinism implies that a specific mechanism in operation will always produce a specific outcome (Mahoney 2001: 580, Falleti and Lynch 2009: 1147), a probabilistic view argues that ‘because mechanisms interact with the context in which they operate, the outcomes of the process cannot be determined a priori by knowing the type of mechanism that is at work’ (Falleti and Lynch 2009: 1147). This difference between viewing mechanisms as univocal links between X and Y or as ‘generative mechanisms’, as Renate Mayntz (2004: 245) puts it, has, as we explain below, important implications on how process tracing is conducted.

To simplify again: in order to understand what links X and Y together, purely quantitative analysis, although indispensable, is not enough, and qualitative research is needed. However, this qualitative research must be informed by theory, either to know in advance where to look for causal mechanisms, or to know what causal mechanisms to test empirically. As Hall (2013) suggests, since a causal mechanism is a statement on how intervening variables and processes linked to them cause a specific outcome, to identify a causal mechanism through process tracing, we need a theory about that mechanism. In other words, as demonstrated by Kreuzer in his article, the perfect researcher for applying this method is an ‘all-rounder’ scholar with experience in historical and theoretical work.

#### 4. The inductive and the deductive uses of process tracing

When doing research, process tracers all move back and forth between empirics and theory,<sup>10</sup> so it is not surprising that virtually all emphasise the dialectic between induction and deduction characteristic of process tracing (see also Bennett and George 1997, Beach and Pedersen 2013, Bennett and Checkel 2015: 7–18, Kreuzer in this issue). However, individual approaches differ in the relative weight they give to inductive and deductive reasoning, which depends on the state of the art of their research question, as well as on their epistemological and ontological view of social reality. Table 2 sorts the different causal process tracing approaches according to the respective weight they place on induction versus deduction. It underscores our earlier point that, despite the large number of process tracing approaches, they each fall more or less into one of these two categories. Meanwhile, we also discern from Table 2 a naming competition of process tracing types that has developed among methodological scholars.

**Table 2.** Types of process tracing.

Name	Description
<b>More inductive types of process tracing</b>	
Process tracing procedure	'A more direct and potentially more satisfactory approach to causal interpretation in single case analysis takes the form of an attempt to trace the process – the intervening steps – by which beliefs influence behaviour. Process-tracing seeks to establish the ways in which the actor's beliefs influenced his receptivity to and assessment of incoming information about the situation, his definition of the situation, his identification and evaluation of options, as well as, finally the choice of a course of action' (George 1979b: 113). See also George and McKeown (1985), George (1979a).
Historical explanation, detailed narrative	'This is the type historians typically seek. Their objective is usually to explain the occurrence of a specific set of events in a limited set of cases, such as the outbreak of the English Revolution in 1640 or of World War I in 1914' (Hall 2008: 305). See also George and Bennett (2005); Bennett and George (1997)*
Process tracing (backward process trace)	'The investigator traces backward the causal process that produces the case outcome, at each stage inferring from the context what caused each cause. If this backward process-trace succeeds it leads the investigator back to a prime cause' (Van Evera 1997: 70).
Process induction	'inductive observation of apparent causal mechanisms and heuristic rendering of these mechanisms as potential hypotheses for future testing' (Bennett and George 1997: 5).
Analytical explanation	'converts a historical narrative into an analytical causal explanation couched in explicit theoretical forms' (George and Bennett 2005: 211).
More general explanation	'the investigator constructs a general explanation rather than a detailed tracing of a causal process' (George and Bennett 2005: 211).
Process Analysis	'Process analysis generates leverage in part by allowing researchers to examine the specific mechanisms through which an independent variable exerts an effect on a dependent variable (George and Bennett 2005). Under this approach, the analyst starts with an observed association and then explores whether the association reflects causation by looking for mechanisms that link cause and effect in particular cases' (Mahoney 2004: 88).
Theory-building process tracing	'In its purest form, theory-building process tracing starts with empirical material and uses a structured analysis of this material to detect a plausible hypothetical causal mechanism whereby X is linked with Y ... Theory-building process tracing is utilized in two different research situations: (1) when we know that a correlation exists between X and Y but we are in the dark regarding potential mechanisms linking the two (X-Y-centric theory building) as we have no theory to guide us; or (2) when we know an outcome (Y) but are unsure about the causes (Y-centric theory building)' (Beach and Pedersen 2013: 16).
Explaining outcome process tracing	'This type of process-tracing can be thought of as a single-outcome study, defined as seeking the causes of a specific outcome in a single case' (Beach and Pedersen 2013: 18 with reference to John Gerring).
Theory guided process tracing	<i>'I define the method of theory-guided process tracing (henceforth, TGPT) as the temporal and causal analysis of the sequences of events that constitute the process of interest. Such process must be clearly conceptualized, both theoretically and operationally, with reference to previous theories. The TGPT method assumes that in these temporal sequences of events, their order is causally consequential.'</i> (Falleti this symposium; italics by Falleti).

(Continued)



**Table 2.** Continued.

Name	Description
<b>More deductive types of process tracing</b>	
Process prediction testing	'In process tracing the investigator explores the chain of events or the decision-making process by which initial case conditions are translated into case outcomes. The cause-effect link that connects independent variable and outcome is unwrapped and divided into smaller steps; then the investigator looks for observable evidence of each step' (Van Evera 1997: 64). 'Process predictions are often unique – no other theories predict the same pattern of events or the same actor testimony on their motives – hence process tracing often offers strong tests of a theory' (Van Evera 1997: 65). 'Congruence procedure and process tracing are stronger test methods than controlled comparison' (Van Evera 1997: 56).
Process verification	'testing whether the observed processes among variables in a case match those predicted by previously designated theories' (Bennett and George 1997:5).
Systematic process analysis	'... this method assumes that observations bearing on a theory's predictions about the <i>process</i> whereby an outcome is caused provide as relevant a test of that theory as predictions about the correspondence between a few key causal variables and the outcomes they are supposed to produce' (Hall 2008: 310; italics by Hall). Hall (2008) defines systematic process analysis as a theory-oriented mode of explanations which compares the historical record with rival empirical expectations derived from theoretical accounts. The method consists of four steps: theory formation; deriving predictions; making observations; drawing conclusions (Hall 2008; similar: Hall 2013).
Congruence method	'The investigator uses a deductive theory or an empirical generalization to generate a prediction/explanation for the outcome of the dependent variable. If the outcome is consistent with the prediction, then there is at least a presumption or possibility of a causal relationship' (George 1997: page number not available). 'control for all but one independent variable at a time by using theories to create expectations about the dependent variable that can be compared to its actual value (George 1997)' (Bennett and George 1997: 1).
Congruence analysis (CON)	'The essential characteristic of the congruence method is that the investigator begins with a theory and then attempts to assess its ability to explain or predict the outcome in a particular case' (George and Bennett 2005: 181). 'Which explanatory approach provides more/new insights? Comparing the descriptive and explanatory merits of different theories' (Haverland and Blatter 2012: 27, Table 1.1). Similar: Blatter and Blume (2008).
Causal process tracing	'What makes the outcome (Y) possible? Revealing the temporal interplay among conditions or mechanisms that lead to specific outcomes' (Haverland and Blatter 2012: 27, Table 1.1). Similar: Blatter and Blume (2008).
Theory-testing process tracing	'In theory-testing process-tracing, we know both X and Y and we either have existing conjectures about a plausible mechanism or are able to use logical reasoning to formulate a causal mechanism from existing theorization' (Beach and Pedersen 2013: 14).
Efficient process tracing	'The core point of efficient process tracing is that it maximizes analytical leverage in relation to the invested resources. It starts from a causal relationship provisionally established through correlation, comparative, or congruence analysis and from a causal mechanism that is specified ex ante; it selects cases that promise external validity in addition to the internal validity established by process tracing; and it confines itself to analyzing those processes that are crucial for an explanation and for discriminating between alternative explanations' (Schimmelfennig 2015: 100-1).

Source: Own compilation.

\*Please note that Hall (2008) and Bennett and George (1997) strongly distinguish historical explanation from process tracing because they miss the theoretical and analytical objective. However, George and Bennett (2005) name 'historical chronicles' as a variant of process tracing.

The most inductive form of process tracing is used to deliver a historical explanation of a specific outcome. In this case, process tracing is close (but not identical) to historical explanations. In the recent literature, further inductive modes of process tracing are called 'process induction', 'analytical explanation', 'process analysis', 'causal process tracing', 'theory-building process tracing' or 'explaining outcome process tracing' (Table 2). The inductive types start with observations and the historical record, and then explore whether the evidence allows for the identification of intervening variables, causal mechanisms or causal chains at work. The objective of these types of process tracing is mainly to contribute to theory building by generating hypotheses and uncovering specific (new) causal mechanisms.

The more inductively oriented types of process tracing also include a mode that views time as playing a key role in the causal explanation, or, in the words of Büthe (2002), that takes ‘temporality seriously’. This refers to narratives that investigate sequences, endogenise explanatory variables, and in which ‘[t]ime itself ... becomes an element of causal explanation, a factor in the model’ (Büthe 2002: 486; on this see also Falletti 2006: 4). As emphasised by Falletti in this symposium,

the comparative advantage of process tracing vis-à-vis other social research methods lies in its potential to uncover the causal mechanisms that link the constitutive events of intensive type of [transformative] processes ... [It supports] medium-range theories that take context and complex causality seriously.

However, more inductively oriented process tracers are not analysing processes without theory. When analysing the sequences that led to particular political decisions, for example, one might use the power resource approach in order to disentangle the preferences and interests of actors and the coalitions they form with each other. One would also be identifying the various sequences of a public policy process with the help of the classical analyses of political decision-making. In other words, inductive analysis of processes does not merely consist of naïve observations of empirical events from which theoretical ideas are derived, but rather forms a theoretically informed analysis (= decomposition) of processes that looks for causal chains between the observed events.

This is why Falletti argues for a ‘TGPT’ of intensive processes, defined as ‘the temporal and causal analysis of the sequences of events that constitute the process of interest’. Such processes must be clearly conceptualised, both theoretically and operationally, with reference to previous theories. The TGPT method assumes that in these temporal sequences of event, the order of events is ‘causally consequential’. The TGPT is most powerful when various sequences are compared. And ‘the method permits the researcher to identify different patterns of sequences and their related causes and consequences’.

The more deductive mode of process tracing is called ‘process verification’, ‘systematic process analysis’, ‘congruence method (or congruence analysis),<sup>11</sup> ‘theory testing’, or ‘efficient process tracing’ (Table 2), and ‘mechanism tracing’ in Derek Beach’s words in this symposium. Here, process tracing starts with theory and assesses the plausibility of empirical expectations drawn from theory by comparing the case evidence with the predictions of theoretical accounts. The researcher collects confirming and contradictory evidence, and evaluates to what extent the record is consistent with theoretical explanations. Deductive process tracers compare the evidence and historical record with theoretical accounts of specific hypotheses about causal mechanisms.

With these more deductive types of process tracing, it is important (but not always easy) to differentiate between analytical narratives (Bates *et al.* 1998) and process tracing (on this see also Falletti 2006: 4, Hall 2008: 314). Analytical narratives are used to demonstrate the validity of micro-foundational theoretical reasoning, like the rational choice approach, through an iterative process that moves back and forth between observations and only one theory in order to refine this theory and seek parsimony (Bates *et al.* 1998: 11), and to ‘illustrate how the theory or formal model works in the real world’ (Falletti 2006: 4). In contrast to those who pursue this rather formal method that primarily aims to refine parsimonious formal modelling, process tracers are more interested in dynamics and less parsimonious in their theorising. They are investigators interested in analysing change, mechanisms, and feedback processes.

Far from neglecting causal complexity, process tracers are actually experts in identifying this type of causality. They seek causal chains and acknowledge the importance of sequencing and timing. They may also use competing and rival theories in order to contrast them with each other, instead of focusing on one specific theory. There is a long debate about what distinguishes process tracers from some historians (for example, George and Bennett 2005, Bennett and Checkel 2015), which we will not repeat in this article. Let us simply state that in our view, in contrast to historians, process tracers must always make their theoretical underpinnings transparent and explicit, otherwise their contribution to theory development and testing remains obscure (grey or black boxed as Derek Beach would put it).

In this more deductive approach to process tracing, a lot of authors, including some contributing to our symposium, have elaborated on how process tracing can be used as a test for causal inference. Mahoney (2012: 2) recently even claimed that process tracing is the ‘most important tool of causal inference in qualitative and case study research’ and ‘can be used as a method for evaluating hypotheses about the causes of a specific outcome in a particular case’. Van Evera suggested that process tracing is able to deliver good tests of theory because ‘process predictions are often unique’ (Van Evera 1997: 65). Through an analysis along the two dimensions of uniqueness and certitude, he differentiated between hoop tests, smoking-gun tests, double-decisive tests and straw-in-the-wind-tests (Van Evera 1997: 31–2). Following Van Evera, the newer literature recommends that process tracing studies employ the Bayesian inference logic. In this symposium, Marcus Kreuzer provides a detailed account of the Bayesian logic applied to process tracing.

In the context of single case studies, this analogy between process tracing and Bayesian statistics requires that causality be defined in set-theoretical (deterministic) terms if one wants to test for causal mechanisms in a very strict deductive sense (for example, Bennett 2008, Collier 2011, Mahoney 2012, Beach and Pedersen 2013, Beach in this symposium). In our symposium, Beach demonstrates how employing a deterministic understanding of a causal mechanism, in which ‘each part of a mechanism is conceptualized as an individually necessary element of the whole’ (Beach and Pedersen 2013: 31), helps to conduct theory tests with the method of process tracing by using the logic of Bayesian updating, because unique and certain predictions on causal processes are made possible. However, some process tracers who are sceptical of set theory may still find the Bayesian logic attractive since it allows them to combine theory building and theory testing aspects when tracing processes (see Kreuzer in this symposium).

Bayesian process tracers argue that the Bayesian logic has a lot in common with process tracing. Bennett (2008: 10) lists three similarities between Bayesian inference and the logic of process tracing. The first is that both give equal attention to the test hypothesis and alternative hypotheses. They contend that the confidence in a test hypothesis is conditional on having given equal empirical attention to rival hypotheses as well as on asking how similar and different their empirical predictions are. They point out that confirming a test hypothesis that makes the same empirical predictions as a rival hypothesis advances our knowledge little because we cannot discriminate between the validity of those two hypotheses. Process tracing and Bayesian analysis therefore place a great deal of emphasis on carefully specifying hypotheses and differentiating them from each other in order to produce what they call strong tests. Second, this close attention to developing strong tests also means that individual pieces of evidence can become ‘far more discriminating among competing explanations than others’ (Bennett 2008: 10). Both discuss the probative or diagnostic value of individual pieces of evidence and therefore rest their causal inferences not exclusively on the frequency of observed pieces of evidence but also on their ability to discriminate among existing hypotheses. Thirdly, both logics’ close attention to the strength of their tests also means that they work with affirmative evidence as well as eliminative induction in order to test theories. Due to this analogy, the literature suggests ‘process tracing tests’ (Mahoney 2012) that process tracers might use to make descriptive and causal inference.<sup>12</sup> The tests are based on the argument that observations are compared with competing and rival explanations (Bennett 2008: 8). In short, as Kreuzer puts it nicely in this symposium: the Bayesian version of process tracing ‘involves a substantive rather than strictly technical testing approach to dealing with causal inference problem’. It embeds causal inference both in the frequency of observed evidence as well as in the quality of the available foreknowledge; it recognises that our ability to learn from evidence is highly conditional on how closely we conduct our literature reviews and specify tests. Test preparation is just as important as testing techniques for making valid causal inferences.

Our reading of the current debate is that two motivations have triggered this convergence between Bayesian logic and some type of process tracing. First, supporters of the Bayesian logic in process tracing claim that it helps to standardise process tracers’ statements on causal inference (Bennett 2008, Rohlfing 2012, Beach and Pedersen 2013; Maggetti *et al.* 2012: 60, Bennett and

Checkel 2015: 16). The second motivation is a methodological one: in combination with a deterministic conception of causal mechanism, using the Bayesian logic makes process tracing a suitable method for analysing causality in MMR without endangering the robustness of causal inference statements.<sup>13</sup> MMR faces the challenge of the ‘stability of causal effects’ (Mahoney and Goertz 2012: 106) because qualitative case studies analyse causality in individual cases while quantitative work analyses causal inferences in populations, by estimating ‘average effects of an independent variable within population’ that ‘may or may not apply to particular cases’ (Mahoney and Goertz 2012: 47). This stability problem can easily be solved with a ‘mechanismic’ understanding of mechanism that defines mechanism as a theoretical system. The initial conditions as well as the outcome (explanandum) are excluded and not part of the mechanism. A deterministic perspective means that no random and no error term occur because a deterministic mechanism produces the outcome with 100 per cent certainty and with no variance (Beach and Pedersen 2013: 27). Slackening determinism by the premise that ‘randomness and chance appear only because of limitations in theories, models, measurement and data’ but not because of purely ‘stochastic factors which ... randomly produce outcomes’ (Mahoney 2008: 420, Beach and Pedersen 2013: 27) opens the door to infer through process tracing least likely explanations by using the standards of Bayesian statistics. In short: as long as we conceive of a mechanism as being deterministic in its operation, Bayesian process tracing is able to generate robust statements of causal inference that can even be added to statistical analysis in MMR.<sup>14</sup>

We must emphasise that Bayesian process tracing is trying to standardise more than any other (within or single) case study method. This standardisation process is still in the early stages. Some approaches employ an implicit Bayesian approach (Bennett 2008, Bennett and Checkel 2015), others use a more formalised and technical approach (Bennett 2015), and still others are trying to integrate those two versions (Kreuzer and DeFina 2015; Kreuzer in this symposium). We do not doubt that the Bayesian version of process tracing is important for the further development of case study methods in general. The contributions by Derek Beach and Marcus Kreuzer illustrate this point nicely and impressively.

However, we also agree with Mahoney and Goertz (2012: 107) that ‘scholars who supplement their statistical findings with process tracing do not appear to use the method in the same way as qualitative researchers’. To adapt their comment to Bayesian process tracing in MMR, we want to emphasise that Bayesian process tracers use the method of process tracing in another way than scholars who do not have a deterministic conception of mechanisms. The transfer of Bayesian statistics and logic into process tracing is a way to eliminate contingency from the explanation. It makes it impossible to analyse those causal mechanisms whose outcomes are not determined a priori by the mechanism which operates, but depends on the temporal and spatial conditions or even on contingency, which is produced by uncertainty.

Marrying mechanism analysis with determinism makes it possible to use the Bayesian causal inference logic in process tracing. For scholars who do not share a strict deterministic view of causality, and who understand mechanism analysis as a way to scrutinise the variability of outcomes when mechanisms operate (on which see Mayntz 2004: 245, Falletti and Lynch 2009: 1147) or as a means to analyse the causal and temporal sequences of events (Falletti and Mahoney 2015), the Bayesian way of causal inference testing through process tracing is blocked. As this strand of process tracers cannot use Bayesian statistics to improve the quality of their explanations, their statements on causal inferences and their possibilities to move beyond a statement that ‘things just happen’ (Mahoney 2008: 420; similar Beach and Pedersen 2013: 27) depend much more (or better – only) on theory grounded case selection and whether the theories they use are able to handle the scope conditions as well as the stochastic factors. For this reason, we argue that one of the greatest challenges of process tracers who have a non-deterministic conception of mechanism and do not apply the Bayesian version of process tracing is to further develop their standards and methodological concepts. They should also be aware that the validity of their causal arguments depends much more on case selection strategies, and thus also on the selection of crucial cases (least likely or

most likely cases; Eckstein 1975), which make theory testing through case studies possible (on this see also Rohlfing 2012, Beach and Pedersen 2013).

## 5. The added values and challenges of using process tracing

A lot of the literature on process tracing underlines that process tracing is very costly, both in terms of time (research) and space (writing). Why bother using this method then? It should be clear that process tracing has to be implemented when it provides specific added value to research that no other method in social science can provide. Our symposium helps us identify these conditions.

As emphasised by Tulia Falleti, one needs process tracing when one assumes that there is a process to be traced, or, to avoid formulating truism, where one wants to understand the mechanisms of change. The main merit of process tracing is to unpack causality and how it develops in time. Hall (2003) highlights that certain ontological claims also lead us to process tracing. If one states that context and time matter, one needs to use process tracing, because things do not happen ‘*ceteris paribus*’ (see also Falleti and Lynch 2009) and mechanisms have to be understood within their specific institutional and historical environment.

Social constructivists that do emphasise historical contingencies will also want to rely on process tracing since no point in time should be theoretically more important than another and thus need equal attention from researchers when tracing the process of transformation (Bennett and Checkel 2015). But even a more deterministic approach to causal mechanisms wants to rely on process tracing in order to grasp the HOW of cause, and go beyond co-variation. As underlined by Derek Beach, ‘tracing the steps of the causal process between X and Y [is] the very reason we would want to engage in the PT of causal mechanisms in the first place’.

Once implemented, there are a lot of good things to be expected from process tracing. For Derek Beach, process tracing enables us to both ‘make *stronger evidence-based inferences about causal relationships* when we have within-case evidence of each step of the causal process (or absence thereof) in-between a cause and outcome, [and it] gives us a better understanding of *how* a cause produces an outcome’.

As all authors agree, process tracing also allows us to adjudicate among competing theories. Moreover, as underlined by Falleti, it can allow for subtle theories: ‘it accounts for endogenously generated or modified preferences,... it can also incorporate feedback effects’. In accordance with Falleti, all our authors emphasise the advantage of taking time seriously. As Kreuzer reminds us, this helps avoiding ex-post functionalist rationalisation.

Finally, process tracing can help bridge the qualitative and quantitative gap and yields much stronger causal inferences for research.

Benefits and values also produce challenges. One such challenge already mentioned herein is the development of non-Bayesian standards for those applications of process tracing that do not assume deterministically operating causal mechanisms (see our proposals in our last section presenting the 10 steps for good process tracing). On the basis of our reading of the literature and of this symposium, three other main challenges are to be mentioned.

First, the Bayesian version of process tracing needs to go further into practice (the Bayesian logic is only rarely really implemented in process tracing studies). Otherwise, this approach risks remaining abstract and divorced from practical research problems. In view of the scarcity of true Bayesian process tracing studies, it is still uncertain whether the Bayesian logic really works in process tracing studies, and indeed generates the promised benefits of robust statements. In this context, we also need practical guidelines on how to calculate probabilities for a priori hypotheses, and for disconfirming and confirming evidence, which are the basis for assessing likelihood ratios (on this see Kreuzer and DeFina 2015).<sup>15</sup>

Second, further work on the epistemological and ontological peculiarities of the different variants of process tracing is necessary. On these issues also, non-deterministic process tracers need to

formalise their approach. Efforts in this direction may help prevent process tracing from becoming a catch word in practical research, around which researchers rally without specifying clearly what they actually mean by process tracing.

Third, the combination of process tracing with other methods in MMR is of course an important (albeit challenging) new area for research (for example, Bennett and Checkel 2015: 272–3). However, despite all the benefits of this kind of research design, the challenge to further developing process tracing as a stand-alone-method should not be forgotten or neglected. As we have shown, in that case, the use of process tracing in pure qualitative research may be based on different epistemological and ontological assumptions.

In our view, the most important lesson of the benefits and challenges of process tracing though is that while in the 1970s and 1980s, friends of statistics and experimental research viewed case studies and process tracing as ‘wrong-headed’ (George and McKeown 1985: 22), research in the last few years has sparked a discussion emphasising the statistics and experimental research without case studies and process tracing may not be appropriate.

## 6. Ten steps for good process tracing

If we agree with all the above positive assessments, we also know that process tracers run the risk of providing poorly performed narratives that only re-enforce some colleagues in their prejudices that qualitative research is not real social science. Hence, we would like to elaborate a series of guidelines for performing the best possible process tracing, on the basis of our own research experience with this method (for example, Palier 2005, (ed.) 2010, Steinlin and Trampusch 2012, Trampusch 2014) as well as on case study research in general and the main conclusions of this symposium. In our view the quality of process tracing could be greatly improved if the following *10 steps* were seriously considered.<sup>16</sup> Our list for good process tracing practices is based on the general premise that the decision about which variant of process tracing is to be applied is part of the research process (and can even change the more we know about the specific case).

- First, as any other empirical social scientist, process tracers need to be aware of and clarify their *ontology*. Following Hall (2003: 374), ontology contains ‘the fundamental assumptions scholars make about the nature of the social and political world and especially about the nature of causal relationships within that world’. For instance, as explained above, it makes a difference whether we conceive of causal mechanisms as operating deterministically or whether we leave room for contingency by having a probabilistic view. Hall (2003: 374) puts it nicely: ‘Ontology is ultimately crucial to methodology because the appropriateness of a particular set of methods for a given problem turns on assumptions about the nature of the causal relations they are meant to discover’. Our ontology contributes to make our decision about the variant of process tracing we apply.
- Second, depending on the state of the art, the status quo of available theories, the availability of data and the research question, the researcher must determine whether his/her *epistemological interest* is inductive or deductive. Is the study’s objective to generate or specify a hypothesis about a causal effect or a causal mechanism, or does it seek a plausibility probe about a causal effect or mechanism that has already been theorised? Note, however, that whether more inductive or more deductive, process tracing in practice is always an iterative process, a back and forth movement between theory and empirical within case(s) evidences. To use Marcus Kreuzers’ words during our long and iterative exchanges about process tracing: ‘the testing of causal links will invariably reveal links that don’t work as advertised. Process tracing thus serves not only an important diagnostic purpose but also the important remedial goal of improving theory development’.
- Third, researchers must be transparent with their epistemological assumption when they are marrying process tracing with other methods. Although applying process tracing in MMR (thus jointly



with Mill's methods, statistics and experiments) is one of the most promising routes for the further development of this method, researchers have to be aware of the epistemological and ontological assumptions on which such combinations are founded.

- Fourth, whatever the variant being chosen, good process tracers need *good theory*, so that they know where to focus their analytical attention, which actors to study and interview and what historical sequences of events to analyse. If the study is a plausibility probe, then competing theories are useful. That aside, the quality of process tracing study is strengthened if the theories used to explore or explain a case have proven their value in previous research.
- Fifth, the theoretical leverage of a process tracing study strongly depends on theory-oriented *case selection*. Here, we recommend applying the case selection strategies suggested by Eckstein (1975), Lijphart (1971) and Gerring (2007); the most important of them for process tracers are the disciplined-configurative study, crucial cases, extreme cases, most likely, least likely, typical cases and deviant cases.
- Sixth, *sound causal process observations* need time, contextual evidence (Gerring 2007: 172) and a 'good knowledge of individual cases' (Mahoney 2010: 131). Various data sources should be used, and interviews conducted. Within this process of data collection, the historical integrity and specificity of the case should be seriously considered. Here, we recommend respecting guidelines on how to minimise the effects of selectivity and bias in the use of primary and secondary sources (Thies 2002, Kreuzer 2010). In addition, measurement validity has to be improved through the use of context-specific domains of observation, context-specific indicators and adjusted common indicators requiring thoughtful data collection (Adcock and Collier 2001).
- Seventh, the use of *counterfactual analysis and mental experiments* may be another important safeguard for good process tracing (similar: George 1997 with reference to the congruence method). This means that a 'series of events in sequence' (George 1997: 7) or parts of a causal chain may be thought as a mental and cognitive construction in cases where there are reality gaps. However, George (1997:7) also rightly acknowledges that this is a difficult and ambitious enterprise.
- Eighth, we should carefully investigate when the processes we analyse have started and when they end. Here, theoretical frameworks as well as sound causal process observations are helpful (see also Falletti and Lynch 2009). Tulia Falletti's differentiation between extensive and intensive processes in this symposium is very useful to that end.
- Ninth, good process tracers follow the current 'transparency revolution' across quantitative and qualitative research, which encompasses 'data transparency', 'analytic transparency', as well as 'production transparency' (Moravcsik 2014: 665–6). While providing an (on-line) appendix with quantitative data has become the norm, adding an appendix with qualitative data such as interviews could be encouraged.
- Finally, researchers should be aware of, and always remember that when it is a *method of causal interpretation of one case*, process tracing is not a causal explanation reached by statistics. However, the more the above steps are closely followed, the better the causal interpretation will be.

## 7. Conclusion

Recent years have seen growing interest in the method of process tracing. Various books and articles have been published discussing not only the ontological and epistemological foundations of this method, but also criteria to standardise and formalise it. This literature also suggests many different definitions of what process tracing actually is. We have counted at least 18 different variants of process tracing. Against the background that there is only three different logics of regression analysis (OLS, Logit and Probit),<sup>17</sup> this high number of variants for the process tracing method is pretty remarkable and proves the 'buzzword problem'. If introducing Bayesian logic within process tracing is a way to standardise this method, we also underlined that applying the Bayesian logic in process tracing *case studies* requires a strict set-theoretical or deterministic view of causality;

otherwise, inference tests following the Bayesian logic would be impossible to implement in a case study. Hence one cannot conclude that the Bayesian way is the only and right way since the deterministic approach to causality is quite restrictive, demanding and even questionable.

In order to simplify the review of debates over process tracing, we have identified two main types of process tracing: those using it in a more inductive way (but in a theory guided way), and those using it in a deductive way (but being always ready to refine the tested theories).

We have underlined that process tracing is certainly the best method to study causal mechanisms, the more inductive way being used for uncovering causal mechanisms and the more deductive manner for testing the theoretically alleged causal mechanism. Because they are able to follow actors' positions and actions, process tracing studies have helped to unravel the mechanisms of changes (in preferences, as well as institutional changes), while bringing time and context back into the explanations. This is why process tracing matters so much for the further development of theory building and testing in social sciences.

## Notes

1. In accordance with Hall (2003: 373), we 'use the term "methodology" to refer to the means scholars employ to increase confidence that the inferences they make about the social and political world are valid'.
2. Due to word restrictions our symposium cannot include this debate on process and variance research in organisation studies but Van der Ven and Pool (2005) gives a good overview.
3. We thank Yves Surel for this term.
4. While Bennett and Checkel (2015: 16) distinguish set theoretical from Bayesian process tracing, we will argue that there are set-theory based and non-set theory based Bayesian process tracers.
5. Concerning explanatory strategies, Mahoney and Goertz (2006) distinguish between the causes-of-effects strategy followed in qualitative studies and the effects-of-causes strategy applied in quantitative research. We agree with this differentiation, however, we also acknowledge that under certain conditions within-cases analysis may also investigate effects-of-causes but in a slightly different manner than quantitative studies do. Process tracers are not able to estimate and quantify any causal effect. What some process tracers do is assessing the 'reality fit' of causal hypotheses, see Beach and Kreuzer in this symposium.
6. Falletti adds to the analysis of intensive processes, the variant of 'extensive process' tracing which may be used for testing theory. However, Falletti also argues that 'the greatest potential and comparative advantage of process tracing as a social science method lies in the analysis of intensive processes ...'. While extensive processes include the cause and the outcome and mobilize the notion of intervening variables (which may also be analysed by statistical methods), intensive processes only work after a cause and they end before the outcome (see Falletti in this symposium).
7. They may also use quantitative data as long as they help to trace processes. On the different types of evidence (among them are also statistical patterns) used in process tracing see Beach in this symposium.
8. While in causal sequential arguments the 'events in a sequence are understood to be causally connected to one another', 'strictly temporal sequential arguments' do not assume that events are causally connected but that the 'temporality of these events (their duration, order, pace, or timing) is causally consequential for the outcome' (Falletti and Mahoney 2015: 216, 218).
9. Bennett and Checkel (2015: 12) define causal mechanisms as:
 

ultimately unobservable physical, social, or psychological processes through which agents with causal capacities operate, but only in specific contexts or conditions, to transfer energy, information, or matter to other entities. In doing so, the causal agent changes the affected entities' characteristics, capacities, or propensities in ways that persist until subsequent causal mechanisms act upon them.
10. In agreement with Eckstein (1975[1992]: 130), with theory we mean in
 

a minimal sense that it must state a presumed regularity in observations that is susceptible to reliability and validity tests, permits the deduction of some unknowns, and is parsimonious enough to prevent the deduction of so many that virtually any occurrence can be held to bear it out.
11. We have to note that George and Bennett (2005), Blatter and Haverland (2012) and Beach and Pedersen (2013) strongly distinguish between process tracing and the congruence method while Gerring (2007: 173, fn. 2) notes that the congruence method is synonymous to process tracing.
12. Again, these are the tests promoted by Van Evera: hoop test, the smoking gun test, the straw in the wind test and the double decisive test (e.g. Collier 2011).

13. With regard to process tracing in multi-method research, see also Dunning (2015) who demonstrates the benefits of process tracing in experimental studies.
14. Renate Mayntz (2004: 245) rightly claims that as long as ‘we look at the whole process and recognize that “inputs” and “outputs” can vary, making outcomes contingent on variable initial conditions’ it does not matter whether we have a generic or mechanistic understanding of mechanisms. But as scholars of the Bayesian version of process tracing just view their deterministic handling of process tracing as an alternative to conception of causality based on probabilism, the definition of causal mechanism does decisively matter.
15. We thank Marcus Kreuzer for this insight.
16. On guidelines for best practices, see also Beach and Pedersen (2013); Bennett and Checkel (2015); Waldner (2015).
17. We thank Dennis C. Spies for this number. The structure of the data (e.g. time series, multi-level) break into further subtypes which, however, are sons and daughters of these three types.

## Acknowledgements

Our very special thanks go to Marcus Kreuzer who helped us to distil the methodological identities of Bayesian process tracers. However, any caveats of our lexical grouping should address us and not Marcus. In addition, we thank Tulia Falletti and Derek Beach as well as the other participants to our panels on process tracing at the CES (Council for European Studies) Conference at Amsterdam in June 2013 for their useful remarks. We are also grateful for the comments by Marek Naczyk on an earlier version of this paper. Last but not least we gained a lot of insight during a workshop on process tracing held in Paris in May 2014 and thank all participants to this workshop.

## Disclosure statement

No potential conflict of interest was reported by the authors.

## Funding

This work has been partly supported by a public grant overseen by the French National Research Agency (ANR) as part of the ‘Investissements d’Avenir’ program LIEPP (ANR-11-LABX-0091, ANR-11-IDEX-0005-02).

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