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A Dynamic and Multifunctional Account of Middle-Range Theories

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ABSTRACT

This article develops a novel account of middle-range theories for combining theoretical and empirical analysis in explanatory sociology. I first revisit Robert K. Merton's original ideas on middle-range theories and identify a tension between his developmental approach to middle-range theorizing that recognizes multiple functions of theories in sociological research and his static definition of the concept of middle-range theory that focuses only on empirical testing of theories. Drawing on Merton's ideas on theorizing and recent discussions on mechanism-based explanations, I argue that this tension can be resolved by decomposing a middle-range theory into three interrelated and evolving components that perform different functions in sociological research: (i) a conceptual framework about social phenomena that is a set of interrelated concepts that evolve in close connection with empirical analysis; (ii) a mechanism schema that is an abstract and incomplete description of a social mechanism; and (iii) a cluster of all mechanism-based explanations of social phenomena that are based on the particular mechanism schema. I show how these components develop over time and how they serve different functions in sociological theorizing and research. Finally, I illustrate these ideas by discussing Merton's theory of the Matthew effect in science and its more recent applications in sociology.

Key words: middle-range theory, Robert Merton, sociological theory, social mechanism, theorizing

Introduction

Robert K. Merton coined the concept of middle-range theory in the late 1940's. Since then the concept has been 'widely discussed, lavishly praised, often misunderstood, sometimes abused, and even "obliterated by incorporation"' (Stzompka 1986: 111). The reason why the notion of middle-range theory continues to draw sociologists' attention seems to be that it promises to integrate different types of research activities, such as theoretical and empirical analysis, micro- and macro-analysis, and basic and applied research. In addition, middle-range theories are often said to create connections between different research fields.

I share the view that Merton's ideas on middle-range theories contain valuable insights for combining theorizing with empirical analysis but I argue that his notion of middle-range theory should be revised before it can be applied in current sociology. I begin my argument by indicating that there is a tension in Merton's (e.g. 1968a) views on middle-range theories: On the one hand, he emphasizes the developing nature of middle-range theories and their multiple functions in sociological research. On the other hand, his definition of the concept of middle-range theory in terms of logically interconnected theoretical propositions is entirely static and focuses on empirical testability of these theories. In order to resolve this tension, I argue that we should reject Merton's static and single-function definition and develop an account of middle-range theories that is consistently dynamic and does justice also to their other functions in sociological research, such as providing concepts for identifying and describing social phenomena to be explained, formulating explanatory questions about them, explaining these phenomena and consolidating theories developed in different research fields.

I build this argument by combining the idea of middle-range theory with the mechanism approach to explanation. Then I propose that middle-range theories should be understood as evolving entities that have three components: (i) a conceptual framework about social phenomena, (ii) a mechanism schema and (iii) a cluster of mechanism-based explanations of social phenomena that are based on

the mechanism schema. I argue that this view allows us to recognize different epistemic functions of middle-range theories and to analyse in detail the interplay between middle-range theorizing and empirical research over time. Although this argument draws on Merton's ideas, my aim is not to provide a historical exegesis of Merton's texts but to clarify and elaborate his most fruitful insights on middle-range theorizing for explanatory sociology.

Merton's concept of middle-range theory

Merton's notion of middle-range theory has often been regarded as one of the most important blueprints for combining theoretical and empirical analysis in sociological research. Yet, many authors have noted that this concept was incompletely defined and somewhat ambiguous in Merton's work (e.g., Blalock 1990: 388; Boudon 1991: 519–20; Crothers 2009; Geels 2007: 629; Gould 1990; Hedström and Swedberg 1998; Hedström and Udehn 2009; Pawson 2000: 283–84; Sztopka 1986: 109–10; Turner 2009). These complaints are understandable given that Merton did not provide a comprehensive definition of the concept of middle-range theory, nor did he develop a detailed methodological program for developing and testing middle-range theories. Without intending to engage in debates about what Merton really meant by the concept of middle-range theory and how this type of theories relate to the other kinds of sociological theories, I briefly describe his characterizations of middle-range theories and identify a tension in his views.

Merton (1948) introduced the concept of middle-range theory to sociologists in a critical commentary on Talcott Parsons' approach to social theory. In a later, more developed and extended discussion, Merton (1968a: 39) writes that middle-range theories 'lie between the minor but necessary working hypothesis that evolve in abundance during day-to-day research and the all-inclusive systematic efforts to develop a unified theory that will explain all the observed uniformities of social behavior, social organization and social change.' In addition to indicating what middle-range theories are not, he also describes some positive features and functions of these theories.

According to Merton (1968a), the main function of middle-range theories is to ‘guide empirical inquiry’ (p. 39). He also writes that this type of theories ‘involve abstractions, but [...] are close enough to observed data to be incorporated in propositions that permit empirical testing’ (p. 39). In addition, he states that middle-range theories ‘deal with delimited aspects of social phenomena’ (pp. 39–40) and are ‘sufficiently abstract to deal with differing spheres of social behavior and social structure, so that they transcend sheer description or empirical generalization’ (p. 68). Even though they ‘are frequently consistent with a variety of so-called systems of sociological theory’ (p. 43), Merton holds that middle-range theories ‘have not been logically derived from a single all-embracing theory of social systems’ (p. 41). It is also important for him that middle-range theories ‘generate an array of theoretical problems’ (p. 45) for sociologists to investigate and that they ‘do not remain separate but are consolidated into wider networks of theory’ (p. 68). Furthermore, he contends that the middle-range orientation enables sociologists to recognize ‘what must still be learned in order to lay foundation for still more knowledge’ (p. 68) and that middle-range theories cut ‘across the distinction between micro-sociological problems [...] and macro-sociological problems’ (p. 68). According to his view, it is also fruitful to imitate ‘tactics of theorizing’ used by classics of sociology when one selects and formulates problems for middle-range theorizing (p. 68). Despite these various characterizations, Merton provides a single-function and static definition of middle-range theories according to which they ‘consist of limited sets of assumptions from which specific hypotheses are logically derived and confirmed by empirical investigation’ (p. 68). This definition only mentions the function of empirical confirmation and focuses on deductively related propositions between the statements describing theoretical assumptions and those describing their empirical consequences, thereby presupposing that middle-range theories are static sets of propositions.

As these citations indicate, there is a tension in Merton’s (1968a) descriptions of middle-range theories: On the one hand he suggests that middle-range theories guide empirical inquiry in various ways, develop in close contact with empirical analysis and may be consolidated into wider networks.

The developmental approach to theorizing is especially prominent in his two methodological essays, ‘The Bearing of Sociological Theory on Empirical Research’ and ‘The Bearing of Empirical Research on Sociological Theory’, as well as in his substantial theoretical essays on the development of particular theories of the middle-range, such as the theory of reference-groups (chapters 10–11) and the theory of role set (Merton 1957). These essays include a number of important observations and illustrations of how empirical research ‘shape the development of theory’ (Merton 1968a: 157) and how sociological theories can be consolidated into networks of middle-range theories. On the other hand, when he defines the concept of sociological theory, Merton (*ibid.*, 39; also 68) relies on the static view of theories, according to which ‘the term *sociological theory* refers to logically interconnected sets of propositions from which empirical uniformities can be derived.’ This view is compatible both with the above definition of middle-range theories and with the hypothetico-deductive model of scientific method. The latter is a normative model for testing of hypothetical theories that are often considered sets of general statements from which statements about empirical phenomena can be deductively derived with the help of statements describing auxiliary assumptions. The static definition that emphasizes empirical testability is often accepted in more recent discussions on middle-range theories. For example, Raymond Boudon (1991: 520) suggests that Merton’s notion of middle-range theory ‘describes effectively what the other scientists [except sociologists] ‘call simply “theory”’, and continues that a scientific theory ‘is a set of statements that organizes a set of hypotheses and relate them to segregated observations.’ Ray Pawson (2000), in turn, contends that Merton’s ‘concept of “middle-range theory” still provides the clearest blueprint of theory-driven empirical inquiry’ (p. 283) but notes that Merton failed to specify ‘all the steps in the design and construction’ (p. 284) of this type of theories. Despite his interesting interpretation of the development of Merton’s reference group theory and useful suggestion to combine middle-range theorizing to the mechanism-based model of explanation, Pawson (e.g. p. 320), much like Merton, ends up defining

middle-range theories in terms of the static set of assumptions from which sociologists deduce ‘an array of propositions’ that describe empirical phenomena.

In contrast to these views, I argue that we should reject Merton’s single-function and static definition and develop a consistently dynamic account of middle-range theories that does justice to their multiple functions in sociological research. The problem with Merton’s definition is that it disregards other activities of middle-range theorizing except empirical testing of theories. In addition, discussions that revolve around this definition tend to highlight the importance of classifying different types of sociological theories while distracting attention from Merton’s methodological ideas on how middle-range theorizing can be combined with empirical analysis.

Middle-range theories and mechanism-based explanations

How, then, should we develop a dynamic view of middle-range theories that allows us to do justice to their multiple functions? In this section, I suggest that a mechanism approach to explanation provides useful conceptual tools for such a project. Before discussing this approach in detail, let me briefly consider its relation to Merton’s work.

Merton clearly assumed that one of the functions of a middle-range theory is to provide an explanation for a bounded range of social phenomena. Nevertheless, his views on sociological explanations were somewhat eclectic and, at least to some extent, problematic. For example, the functional explanations that Merton sometimes developed in his substantial research (despite the fact that he also perceptively criticized functionalism in sociology) have been convincingly criticized by some of his commentators (e.g. Elster 1983: chapter 2; Turner 2009: 203–6). However, Merton was also one of the first sociologists who systematically used the concept of social mechanism. He defined social mechanisms as ‘the social processes having designated consequences for designated parts of the social structure’ (Merton 1968a: 43). Peter Hedström and Lars Udehn (2009: 32) have also noted that many of Merton’s sociological theories can be interpreted as ‘accounts of mechanisms rather than as general axiomatic systems.’ His theories of the Matthew effect (Merton 1968b; 1988), of the self-fulfilling

prophecy (Merton 1968a: chapter 13) and of the social mechanisms that sustain role sets (Merton 1957) are the clearest cases in point – and Merton, too, called them social mechanisms. In addition to Hedström and Udehn (2009) and other analytical sociologists, the affinity between Merton’s notion of middle-range theory and the idea of mechanism-based explanation has been recognized by several other scholars who do not associate themselves with the movement of analytical sociology (e.g. Little 2011: 278; Pawson 2000; Tilly 2010). For these reasons, I submit that Merton’s notion of middle-range theory can be further developed by drawing on the mechanism approach.

Hedström (2005: 232) aptly states that ‘the core idea behind the mechanism approach is that we explain not by evoking universal laws, or by identifying statistically relevant factors, but by specifying mechanisms that show how phenomena are brought about.’ Though this much is agreed by the most advocates of the mechanism approach, there is no consensus about how to define the concept of causal mechanism (see Gross 2009; Mayntz 2004; Hedström and Ylikoski 2010). Yet, I find Hedström’s (2005: 25) abstract and concise definition sufficient for the purposes of this article:

[causal] mechanisms can be said to consist of entities (with their properties) and the activities that these entities engage in, either by themselves or in concert with other entities. These activities bring about change, and the type of change brought about depends upon the properties of the entities and the way in which they are linked to one another.

This ontic (or realist) definition draws on Peter Machamer’s and his collaborators influential article on the mechanistic philosophy of science (Machamer, Darden and Craver 2000). It implies that causal mechanisms are neither intervening variables nor pieces of theories. Furthermore, this definition can be effectively used to differentiate the mechanism approach to explanation from the functional, the structuralist, the unificationist and the covering-law models of explanation. It also seems to be compatible with more specific ontic accounts of causal mechanisms in the social sciences (e.g. Archer

2015; Bunge 1997; Goldthorpe 2007; Gross 2009; Little 2011, 2016; Manicas 2006; Mayntz 2004; Pawson 2000).

The highly abstract view of causal mechanisms should be specified when applied in sociological research. A plausible way to do so is to combine it with the idea of action-based explanation in which many structurally situated and interacting social actors (with desires, beliefs, emotions, attitudes, interests, heuristics, cognitive frames, biases, habits etc.) form the core entities of social mechanisms (e.g. Elster 1989; Hedström 2005; Hedström and Ylikoski 2010; Manicas 2006; Little 2016). In this view, theoretical representations of social mechanisms should specify the assumptions that sociologists make about social actors – including their properties, opportunity structures and activities – and the relations between these actors and their modes of interaction. Nevertheless, in contrast to what some sociologists have claimed (e.g. Goldthorpe 2007; Gross 2009; Hedström 2005), I do not see any compelling reasons why the mechanism approach should be tied to a specific theory of action (cf. Hedström and Ylikoski 2010: 60–1). Hence, my view is that many complementary action theories can be utilized in developing mechanism-based explanations (Kaidesoja 2012) and that at least some organizations (e.g. corporations, governments and universities) may be counted, too, as purposive actors in some mechanism-based explanations – in addition to the types of human individuals – since it is plausible to attribute causal properties and purposes to suitably organized groups (Kaidesoja 2013).

When we appeal to a social mechanism in an explanation of the outcome of a concrete social process, we can expect that it is intertwined with other mechanisms (and various contingent occurrences) whose concatenations generated the observed outcome (cf. Gambetta 1998; Hedström 2005: 56–8; Manicas 2006). For this reason, mechanism-based explanations often explain by isolating only the key aspects of the causal structures of concrete social processes (Hedström and Ylikoski 2010, 61–2). In some occasions, it is also reasonable to assume that the operations and outcomes of a social mechanism depend on the particular type of structural conditions that may, for example, enable,

stimulate, constraint or channel social interactions (e.g., Hedström and Ylikoski 2010: 60; Mayntz 2004; Pawson 2000: 296–7). In cases of this kind, these broader structural conditions, such as role structures, network structures, infrastructures or institutional frameworks, should also be cited in mechanism-based explanations of social phenomena.

Toward a dynamic and multifunctional account of middle-range theories

On the basis of the previous discussions, I propose a new interpretation of middle-range theories by distinguishing three evolving components of a middle-range theory that perform different functions in sociological research:

- (i) *A conceptual framework about social phenomena* is an evolving set of interrelated concepts that is used at least for four epistemic purposes: (a) identifying, describing and empirically establishing a class of social phenomena that is worth explaining; (b) formulating explanatory questions about social phenomena; (c) developing one or more hypothetical mechanism schema(s) that can be used to explain one or more social phenomena; and (d) specifying the relations between closely related social phenomena.
- (ii) *A mechanism schema* is an abstract and incomplete description of the social mechanism that is applied to specific explanatory tasks in order to provide mechanism-based explanations for one or more social phenomena (cf. Darden 2002: S356). An evolving toolbox of interrelated mechanism schemas that is built in sociological research also embodies general knowledge about the social world (cf. Hedström and Ylikoski 2010: 61).
- (iii) *A cluster of mechanism-based explanations* consists of all explanations of social phenomena that are based on the particular mechanism schema. The procedures through which sociologists apply the mechanism schema to different explanatory tasks may not only enable them to provide evidence for the hypothesis derived from the schema and to specify its area of applicability (or scope conditions). They may also be used to offer empirically based reasons to refine, revise or reject the mechanism schema. When they apply the mechanism

schema to a new explanatory task, sociologists may use the earlier explanations included in the cluster as their exemplars.

In this view, social phenomena addressed in middle-range theories are typically the types of outcomes that are produced by the social processes that have a similar causal structure. Following analytical sociologists (e.g. Hedström and Udehn 2009; Hedström and Ylikoski 2010: 61–2), I assume here that middle-range theories can be classified by focusing on their mechanism schemas.ⁱ Unlike analytical sociologists, I emphasize that, in addition to a mechanism schema, we should also include a conceptual framework about social phenomena and a cluster of mechanism-based explanations as components of a middle-range theory that is applied to explain a range of social phenomena. In what follows, I briefly elaborate each component, their interrelations and my reasons to include them as evolving parts of middle-range theories. These views are partly descriptive and partly prescriptive: I not only aim to provide a plausible account of the actual research practices pertaining to middle-range theorizing but also make some suggestions how to improve these practices.

Although the evolving conceptual frameworks about social phenomena are not usually included as parts of middle-range theories, I think that they should be for at least two reasons. The first is that, as already noted, they are crucially important for many different epistemic purposes in explanatory sociological research. I take this point to be obvious. Hence, it is a mistake to reduce the role of interrelated concepts about social phenomena to a single epistemic purpose — such as empirical testing of theories by using deductive procedures — that they may serve at a particular phase of research process and, thereby, to ignore other functions of evolving conceptual frameworks in sociological theorizing. These views are in line with the so called grounded theory approach (e.g. Glaser and Strauss 1967) to theory-building but my emphasis on mechanism-based explanations and abductive reasoning distinguishes my account of middle-range theories from grounded theorizing.

The second reason is that also Merton clearly recognized that conceptual schemes (in my terminology: conceptual frameworksⁱⁱ) about social phenomena are important in middle-range

theorizing. Merton (e.g. 1957; 1968a; 1968b; 1976) not only developed many highly useful sociological concepts, classifications and typologies in his theoretical work. He also wrote that ‘it is only when [...] concepts are interrelated in the form of a scheme that a theory begins to emerge’ (Merton 1968a: 143) and that more general conceptual schemes are needed to ‘consolidate groups of special theories’ (p. 51). Nevertheless, one of the core messages of Merton’s work in sociological theory is that there is no ‘master conceptual scheme’ (p. 51) that would enable sociologists to unify all social phenomena. In my view, it would be futile to even try to develop such a master scheme given the heterogeneity, complexity and historicity of social phenomena studied in sociology (see also Little 2016). Hence, it is reasonable to assume that all conceptual frameworks about social phenomena are more or less local even though it is occasionally possible to consolidate two or more frameworks developed in different research fields by means of constructing more abstract conceptual categories.

The adequacy of sociologists’ conceptual frameworks about social phenomena depends partly on the specific epistemic aims of their users and partly on the nature of those social phenomena being studied. This means that sociologists may define and classify a particular social process (or some of its aspects) by using many different conceptual frameworks depending on their epistemic purposes. Nevertheless, I suggest that in middle-range theorizing sociologists commonly aim to develop a systematic conceptual framework that provides a context for a series of empirical studies that may be said to articulate the framework. Since they build frameworks of this kind on the basis of their empirical observations and data analysis, the concepts included in the conceptual framework of a middle-range theory can be assumed to consist of the accounts of the key attributes of a range of interrelated social phenomena, the key relations between these attributes and the key dimensions of their variation. Next I will outline four procedures that can be used in articulating and transforming conceptual frameworks about social phenomena (cf. Merton 1968a: chapter 5).

The first procedure consists of *enriching the concepts in the framework*. In this research activity, sociologists add new attributes or dimensions to the concepts that are included in the conceptual framework on the basis of what they have learnt about the social phenomenon under investigation. For example, a sociologist may propose a new definition for Merton's (1968b) concept of Matthew effect in science that further specifies its key attributes or adds new attributes to the concept without modifying those already included in it (I will consider Merton's middle-range theory of the Matthew effect in science more closely in the next section).

The second procedure is comprised of *horizontal integration of new concepts to the framework*. When using this procedure, sociologists add new conceptual categories to the framework such that these categories are considered as the subcategories of the more abstract and general theoretical category that is already included in the framework. This procedure not only requires that one defines the key attributes of each category added to the framework. One should also specify how each new category is different from the other categories at the same conceptual level. For example, a sociologist may develop conceptual categories for new subtypes of Matthew effects in science by defining their key attributes and how they differ from those subtypes that have been already conceptualized by Merton and other sociologists of science.

The third procedure, in turn, involves *vertical integration of new concepts to the framework*. The idea here is that a sociologist introduces a new abstract category to the framework that connects different concepts (or creates a conceptual bridge between different conceptual frameworks) that were earlier regarded as separate. This can be done by means of abstracting the common attributes from two or more categories used in different conceptual frameworks. For example, in one of his later papers on the Matthew effects in science, Merton (1988) vertically integrates the highly abstract category of *accumulation of advantage* to the conceptual framework pertaining to the Matthew effects in science. This highly abstract category has enabled sociologists to consolidate the Mathew effects in science, the bandwagon effects in elections and the path-dependent increasing returns in economy as subtypes

of the same general social phenomenon, which is the accumulation of advantage (e.g. DiPrete and Eirich 2006; Rigney 2010; Zuckerman 1998). In this way, sociologists can build theoretical bridges between middle-range theories developed in different fields of social research.

None of the three procedures discussed so far changes the relations between those concepts that are already included in the conceptual framework about social phenomena. Rather, they are used to enrich the concepts included in the framework or to expand the framework by specifying new horizontal and vertical relations between the old concepts included in the framework and the new concepts that are introduced to it. In contrast, the fourth procedure of modifying the conceptual framework is more radical since it consists of *restructuring of the framework*. When using this procedure, sociologists make such conceptual innovations that change the relations between the concepts that are included in the framework.

For instance, when he coined the concept of *role set*, Merton (1957), at least arguably, restructured the conceptual framework of the earlier functionalist role theory in which social positions in social systems (e.g. schools, factories or companies) were associated with unified social roles. Merton's core claims were that (i) a single social position (e.g. a position of the primary school teacher) is associated with (or has its key attributes) many role relations (e.g. teachers' relations to pupils, colleagues, school principal and parents), which comprise the role set of the position, and that (ii) different role relations associated with a social position often include mutually incompatible expectations regarding the role incumbents' behaviour in the position. This conceptual innovation not only enabled him to restructure the conceptual framework of the earlier functionalist role theory where a single social position was associated with a single role, defining a unified set of behavioural expectations. It also allowed Merton to develop new ideas and research questions about those social mechanisms that enable the members of organized groups to sustain their activities and groups over time in situations where each member faces mutually incompatible expectations regarding her social activities in her social position.

Let us move on to the second component of a middle-range theory. If we accept the mechanism approach to explanation, it is clear that an empirically established phenomenon cannot be explained by merely (re-)describing it in terms of a conceptual framework. What is needed to provide mechanism-based explanations for social phenomena are mechanism schemas that can be used to answer the explanatory questions about these phenomena: why and how this phenomenon is/was brought about? Hence, *a mechanism schema*, understood as an abstract and incomplete description of a social mechanism, forms the second component of a middle-range theory. When sociologists provide mechanism-based explanations for those social phenomena that they have identified and described using the conceptual framework, they apply the mechanism schema to a particular explanatory task. I will return to this procedure when I address the cluster of mechanism-based explanations. Next I will focus on outlining some procedures through which new mechanism schemas may be built and articulated.

Sociologists may develop new mechanism schemas by inferring them *abductively* (or *retroductively*) from their descriptions of the empirically established social phenomena (cf. Swedberg 2014; Tavory and Timmermans 2014). According to Charles S. Peirce (1934: 171–172), abduction ‘is the process of forming an explanatory hypothesis’. Without going into details of Peirce’s philosophy of science, I assume here that a sociologist may use abduction to re-conceptualize the social phenomenon of her interest as an outcome generated by a hypothesized social mechanism that is described in terms of a new mechanism schema. The fallible inferences of this kind may be facilitated by means of analogical reasoning from the available mechanism schemas and already accepted mechanism-based explanations (cf. Becker 2014: Chapter 3). Also the method of theory-building process-tracing (e.g. Beach and Pedersen 2013; Kaidesoja 2018) and the abstract theoretical ideas provided by a researcher’s *general sociological orientation* might be helpful here (cf. Merton 1968a: 141–43). A detailed discussion of these inferences and procedures exceeds the scope of this article.

When sociologists develop new mechanism schemas that can potentially be employed in explaining a delimited range of social phenomena, they should describe at least the key social actors (with their causally relevant properties) as well as their activities, relations and interactions that could underlie or produce the phenomena of interest. In some cases, a mechanism schema may also include description of those temporal stages that link the triggering conditions of the causal mechanism (if they are known) to the outcome that it produces. Descriptions of these stages should meet the requirement of productive continuity according to which the earlier stage of the mechanism should be capable of producing the next stage of the mechanism. In addition, a description of the context(s) where the mechanism is expected to operate can be added to the mechanism schema to specify its area of applicability (or scope conditions).

Mechanism schemas of this kind provide sociologists with abstract representations of causal mechanisms that they can use to isolate what might be called ‘the causal interaction structure’ shared by the classes of causally similar social processes – or at least the most important aspects of this structure (cf. Hedström 2005, 26; Hedström and Ylikoski 2010: 52–3). Hence, mechanism schemas are not empirical generalizations about social phenomena nor are they directly abstracted from empirical descriptions of social phenomena. Rather, as already indicated above, mechanism schemas are theoretical constructs about causal mechanisms that sociologists *abductively* infer from their descriptions of social phenomena by using the theoretical resources available to them. In addition, sociologists may also confirm, refine, revise or reject mechanism schemas on the basis of evidence provided by the studies where they seek to apply the schema in order to explain social phenomena.

The third component of a middle-range theory consists of the cluster of those explanations that are based on the mechanism schema. These mechanism-based explanations can be expected to form a cluster in the sense that they (more or less) resemble each other for two reasons: (i) they are based on the same mechanism schema that ties them together and (ii) sociologists tend to use earlier explanatory studies as their exemplars in their later studies that apply the same schema. When a

mechanism schema is applied to a particular explanatory task, it is concretized by filling in its attributes such that it becomes suitable for the social phenomenon under study. In addition, new evidence that can be used in the empirical evaluation of the hypothesized mechanism-based explanation is acquired in this research activity (cf. Hedström and Ylikoski 2010: 52–3). What is the proper level of concreteness and spatiotemporal scale of the descriptions of the social actors, activities, interactions and outcomes of the social mechanisms depends on a particular explanatory task of the researcher and the methods that she uses. Though the detailed analysis of different explanatory tasks goes beyond the scope of this paper, it is useful to make a rough distinction between two research designs that allow sociologists to provide causal explanations of social phenomena.

The first consist of *experimental and quasi-experimental designs* that are based on the logic of randomized controlled experiments that use randomly assigned test and control groups. This type of research designs enable sociologists to produce evidence for causal claims and causal models which, in their simplest form, are propositions representing the relations of dependence between the values of the independent variable, which are experimentally manipulated, and the values of the dependent variable. Sociologists may use the conceptual framework about social phenomena as a source of concepts that are operationalized in this type of designs. Also mechanism schemas could be employed in developing theoretical hypothesis and statistical models that may be utilised in building experimental designs. However, the real strength of experimental designs is that they allow to make inferences about the average-effects of the cause variables in a population under study. In other words, experimental methods provide an effective way of controlling the effects of confounding variables in those research situations where (at least the most important) assumptions for their application are met — situations which are relatively rare in sociology (e.g. Goldthorpe 2007, 196–203). Sociologists may also use this type of research designs to raise new research questions about those social mechanisms that may link the manipulated cause variables to their average-effects, but experimental and quasi-experimental designs do not enable them to provide evidence about the details of social

mechanisms nor evidence for deciding whether and how a specific causal mechanism unfolds in a particular case. To these ends other kinds of research designs are needed.

Some advocates of the mechanism approach have argued that *case study research designs* are useful for developing and empirically testing mechanism-based explanations of social phenomena, especially if social scientists utilise many different sources of evidence regarding the hypothesized causal mechanisms and use process-tracing in their case studies (e.g. Beach and Pedersen 2013; George and Bennett 2005; see also Becker 2014). These authors seem to agree that process-tracing provides effective methodological tools for making *within-case causal inferences* about the operations of a causal mechanism in a particular case. In this view, the case study designs employing process-tracing can be said to complement experimental and quasi-experimental designs. They provide promising opportunities for developing new mechanism schemas and testing mechanism-based explanations of the cases of a social phenomenon (Kaidesoja 2018). Nevertheless, process-tracing should be combined with the small-N comparative, the statistical and/or the experimental methods if one wants to make cross-case causal inferences (e.g. Beach and Pedersen 2013). How exactly these different types of research designs and methods may be fruitfully combined in empirical research is currently discussed in the context multi-methods research.

No matter which type of research design she chooses, a sociologist who applies a mechanism schema to a particular explanatory task should compare the hypothesized explanation with the competing explanations of the social phenomenon. To this end she needs to provide empirical evidence that discriminates between competing explanations (e.g. Hedström and Ylikoski 2010: 52–3). If the hypothesized explanation accounts the empirical evidence better than the competing explanations, it can be added to the cluster of mechanism-based explanations. It is also possible that there are two or more explanations that are equally well supported by the relevant evidence which means that the evidence alone does not allow sociologists to infer which one is the best explanation. Attempts to apply the mechanism schema may also provide empirically based reasons to refine, revise or reject

the schema. New mechanism schemas that sociologists develop on the basis of what they have learned from the failed applications of the old mechanism schemas should be evaluated by means of acquiring new evidence that is independent from the evidence that was used to disconfirm the earlier version of the schema.

It is important to note that the above views are strictly speaking incompatible with the hypothetico-deductive model since the relation between a mechanism schema and an explanation based on the application of this schema is not a deductive relation for at least two reasons. The first is that abstract mechanism schemas do not always take the form of propositional statements (that are required by the hypothetico-deductive model) but may also be represented in the form of diagrams, flow-charts or computer simulations that are not translated to propositions. The second reason is that the proper application of the abstract mechanism schema requires that sociologists fill in the schema on the basis of inductive analysis of the social phenomenon under explanation. This procedure is different from the procedure of specifying the auxiliary assumptions in order to deduce empirically testable consequences from the set of abstract theoretical statements. Though the procedure of filling in the mechanism schema may allow sociologists to develop a hypothetical model that can be tested by using deductive methods, this model is a particular application of the mechanism schema rather than the abstract schema itself. This is not to deny, however, that the assumptions included in mechanism schemas should be compatible with what is known about the relevant entities, activities, relations and interactions on the basis of earlier empirical studies in sociology and in other relevant sciences (Hedström and Ylikoski 2010: 60–61).

The case of Matthew effect

To briefly illustrate these rather abstract ideas, I reconstruct Merton's (1968b) theory of the Matthew effect in science in terms of the above account of middle-range theories. Merton begins his famous paper on Matthew effects by describing his observations about the reward system of science. These four are among the most important and carefully documented observations:

- (i) Rewards in science are mostly based on peer-recognition and highly unevenly distributed among scientists;
- (ii) There is a very limited number of many awards (e.g. Nobel Prizes or chairs in National Academies) in science, resulting in situations where some scientists equally merited to those of the awarded do not get an award;
- (iii) In the cases of collaboration (e.g. writing a paper together) between the widely recognized scientists and their less recognized collaborators, the credit of the joint contributions to science tend to be allocated only to the already famous scientists;
- (iv) In the historical cases of multiple independent discoveries by the widely recognized and unknown scientists, scientific discoveries tend to be attributed only to the already famous scientists (pp. 56–58).

Merton (1968b) argues that these and some other observations provide evidence for the phenomenon of widening inequality in recognitions among scientists that is only partly explained by the scientific quality of their contributions. He names this phenomenon as ‘the Matthew effect in science’. Merton also tells us that these observations are based on many sources, including the previous research in the sociology of science, citation indices, the well-known facts about the reward system of science and Harriet Zuckerman’s interviews with Nobel Laureates in the US.

In his descriptions of these observations, Merton (1968b) utilises the interrelated concepts pertaining to scientific institutions and activities, including the concepts of reward and communication system of science, peer-review, scientific collaboration and multiple discovery. These concepts that have been specified in Merton’s and his collaborators’ earlier work in the sociology of science may be said to form an evolving conceptual framework that enabled him to identify, describe and empirically establish the phenomenon of Mathew effect and some of its subtypes. In combination with his general sociological orientation, the conceptual framework also served as basis for his abductive inferences about those social mechanisms that could generate Matthew effects in science. Hence, I suggest that

this evolving conceptual framework can be understood as a component of the middle-range theory of Matthew effect.

As all sociologists know, Merton coins the memorable term ‘Matthew effect’ by referring to the Gospel according to Matthew which states that ‘For unto every one that hath shall be given, and he shall have abundance: but from him that hath not shall be taken away even that which he hath’ (Merton 1968b: 58). In the context of science, then, ‘the Matthew effect consists in the accruing of greater increments of recognition for particular scientific contributions to scientists of considerable repute and the withholding of such recognition from scientists who have not yet made their mark’ (p. 58). In this definition, Merton integrates a number of previously unconnected observations about science and suggests that they may be understood in terms of those social processes that tend to accumulate recognitions disproportionately to scientists whose earlier scientific contributions are already widely recognized. The definition presupposes the contrast between the social processes where the Matthew mechanisms generate Matthew effects and the counterfactual processes where recognitions were allocated solely on the basis of ‘the objective scientific quality’ⁱⁱⁱ of scientists’ contributions to science and where the reputations and former merits of scientists would not, therefore, affect the allocation of recognitions in science. In other words, the Matthew effects in science violate the norm of universalism, according to which scientific contributions should be evaluated using “*pre-established impersonal criteria*”, that Merton (1968a: 607) argued to characterize the ethos of science.

In his descriptions of the phenomenon of Matthew effect, Merton (1968b: 58, 62; 1998: 613–617) already hints that this effect may be understood as the outcome of social mechanisms (hereafter: Matthew mechanisms) that misallocate recognitions and rewards in science. Though Merton (e.g. 1988: 616) acknowledges that, especially in the early career stages, the role performance of the scientist which exceeds the expectations of the relevant others may trigger Matthew mechanisms that accelerate her career, Merton (1968b: 57–9) also emphasizes that, in the long run, these mechanisms

generate such cumulative advantages and disadvantages between researchers which cannot be accounted by referring to exceptional role performance, talent or the scientific quality of the contributions of individual scientists alone. These considerations raise two questions: What are these Matthew mechanisms that contribute to the skewed distribution of recognitions by misallocating recognitions and resources in science? How do they operate in different institutional settings?

Although Merton (1968b) does not use the notion of mechanism schema, his descriptions of Matthew mechanisms can be usefully articulated with the help of this notion. Hence, I suggest that a qualitative schema of Matthew mechanism includes the following elements (I have bolded the terms that refer to different types of actors):^{iv}

- (i) *Actors* (with properties): **researchers** (who are capable of doing research, affiliated to different research organizations and aim to advance their careers) and **resource providers** (who are capable and authorized to allocate resources for research and tend to believe that the reputation and past contributions of a **researcher** are the reliable indicators of her current and future contributions to science).
- (ii) *Activities of actors*: **researchers** not only produce scientific contributions by exploiting the available resources and opportunities but also apply new resources for further research; **resource providers** select **researchers** to whom they allocate resources on the basis of their perceived reputations, track records and other particularistic standards that are used to assess scientific quality.
- (iii) *Relations and interactions*: the relations of competition between **researchers** for scarce resources and the relations of scientific collaboration between **researchers** that in concert give rise to the positive feedback loop that is maintained by the social interactions between **researchers** and **resource providers** through which already **resourceful researchers** tend to acquire a disproportionate share of the available resources for

research, providing them with further opportunities to acquire new resources for research more efficiently than **less resourceful researchers**.

- (iv) *Outcomes*: the skewed distribution of resources for research between **competing researchers** and the amplification of the small initial differences in resources between **researchers** over time.

This is a mechanism schema since the attributes of researchers and resource providers and their activities are highly abstract and incomplete. In other words, the schema does not make references to any particular time or place nor does it detail the nature of resources or the identity of relevant actors, meaning that the basic explanatory concepts have not (yet) been operationalized (in the broad sense). Hence, the Matthew mechanism schema aims to provide an abstract representation of those social mechanisms through which scientific success tends to breed more success, but the schema does not by itself answer any specific research question about any concrete social phenomenon.

I propose that Merton's (1968b) essay contains two concretized versions of this highly abstract mechanism schema. The first one is the variant of Matthew mechanism that operates through the citation practices in the context of scientific communication. In this variant, peer-recognitions embodied in citations in peer-reviewed journals are the key 'symbolic resources' (or recognitions that can be later translated into resources) that researchers allocate to each other. The second one is the variant of Matthew mechanism operating in the context of the reward system of science. In this variant, the key resources consist of scientific awards, research grants and positions in prestigious universities that are allocated to researchers by the award committees, the recruiters of universities and the funding organizations. Merton's descriptions of these two subtypes of Matthew mechanisms share the assumption that Matthew effects are generated as an unintended outcome of self-reinforcing interactions in a certain institutional context where researchers compete for scarce resources. Though these descriptions fill in some attributes of the abstract Matthew mechanism schema, they are still fairly abstract and incomplete. In one of his later papers, Merton (1988: 617) also mentions Matthew

mechanisms that operate ‘among scientific institutions’, such as competing universities, and proposes that Matthew effects in science can be seen as a subtype of the general pattern of accumulation of advantage and disadvantage (see also Zuckerman 1977; 1998).

When the Matthew mechanism schema is applied to a particular explanatory task, it should be filled in to meet the requirements of these tasks and evaluated in the light of new and relevant empirical evidence. This can be done by employing different types of research designs (for reviews of empirical research pertaining to Mathew effects and accumulation of advantage, see DiPrete and Eirich 2006; Merton 1988; Rigney 2010; Zuckerman 1998). Some sociologists who have studied Matthew effects in science have used quasi-experimental designs and comparative statistical analysis to investigate whether and to what extent Mathew effects can be found in and between different populations of researchers that are differentiated, for example, in terms of age, gender, class origin, or discipline. Studies of these kinds presuppose the existence of causal mechanism(s) that produce Matthew effects in different populations and require the specification of the triggering conditions of this mechanism.^v They might also enable sociologists to control the effects of ‘the objective scientific quality’ of scientific contributions in order to isolate the Matthew effects in a population of interest. However, the main limitation of the research designs of this kind is that they do not enable sociologists to develop or evaluate theoretical hypothesis about *how*, or through which social mechanisms, Matthew effects are generated.

Hence, I propose that studies of this kind should be complemented by using case-based research designs to produce within-case evidence about the Matthew mechanisms operating in different types of institutional contexts. A recent example of this type of study is Barbara Hoenig’s (2017) case study that aims to shed light on why and how the European Research Council (ERC) -funding in Europe has produced a new scientific elite through the Matthew mechanisms^{vi} that are composed of competing researchers, research groups, disciplines, universities and countries in the European Research Area. Although she does not use the term mechanism schema, from the viewpoint of the

previous account, Hoenig's study can be said to apply the Matthew mechanism schema to explain why and how the institutionalization of the ERC-funding has reinforced social inequalities and stratification in the European Research Area. In her descriptions of the Matthew mechanisms of this kind, she can be said to fill in the Matthew mechanism schema with the following the details:

- Description of the cultural and social structure of European research funding that emphasizes 'excellence by competition' and structures the opportunities of researchers in different research organizations located in different countries;
- Descriptions of researcher's collaborations in team building and of their mentor–apprentice relations and other network relations;
- Descriptions of ERC panellist's interactions when they evaluate the research proposals of researchers following the pre-defined standards and institutional rules for decision-making that are not entirely unbiased;
- Specifications of different feedback loops through which ERC-funding decisions affect the kind of knowledge produced by researchers; the rates of growth of different disciplines; the growing gaps in funding between different types of research organizations and between different countries; and the downward and upward spirals in careers of individual researchers in the European Research Area (Hoenig 2017).

While it is impossible to do justice to Hoenig's rich case study here, it is a good example of the case study that carefully theorizes Matthew mechanisms that operate in the context of ERC-funding and provides evidence from multiple sources for its claims about their operations and outcomes. Hence, I suggest that Hoenig's study can be added to the cluster of mechanism-based explanations that can be said to apply the Matthew mechanism schema to specific explanatory tasks. Although its consideration of alternative explanations is somewhat limited, her study provides an exemplar for new case studies that aim to trace Mathew effects in other institutional contexts where Matthew mechanisms can be expected to unfold slightly differently due to the contextual differences.

Conclusions

Drawing selectively on Merton's work and recent discussions on mechanism-based explanations, I have argued for a dynamic and multifunctional understanding of the concept of middle-range theory. In this view, middle-range theories consist of three evolving components — a conceptual framework about social phenomena; a mechanism schema; and a cluster of mechanism-based explanations that are based on the mechanism schema — that perform different functions in sociological research. All of these components are involved when sociologists provide mechanism-based explanations for social phenomena. I also reconstructed the middle-range theory of Matthew effect in terms of this account and formulated some procedures and heuristics for combining theoretical and empirical analysis in explanatory sociology and for organizing sociological knowledge.^{vii}

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ⁱ An alternative way of classifying sociological theories of the middle-range would be to differentiate them according to (the types of) social phenomena they aim to explain (see Kaidesoja 2018).

ⁱⁱ I use the term ‘conceptual framework’ instead of ‘conceptual scheme’ since I want to distinguish the notion of conceptual framework from the vague neo-Kantian idea of conceptual scheme which allegedly structures the whole phenomenal world (cf. Turner 2009: 178–81). Though it seems to me that Merton does not use the term ‘conceptual scheme’ in the neo-Kantian sense, this term can lead to unnecessary confusions that can be avoided by using another term.

ⁱⁱⁱ The notion of ‘objective scientific quality’ is difficult to define and assess although its effects may be controlled by comparing essentially similar contributions to science. It also raises thorny epistemological issues that cannot be addressed here.

^{iv} In my reconstruction of the Mathew mechanism schema, I employ the notion of ‘resources for scientific research’ to cover both peer-recognitions and material resources (e.g. funding) of scientists. My justification for this is that peer-recognitions in science can be considered symbolic resources that can also be translated to material resources for scientific research through writing applications for research grants and research positions at universities (cf. Merton 1988; DiPrete and Eirich 2006, 281-282).

^v It should be noted, however, that in some discussions on Matthew effects intervening variables (see DiPrete and Eirich 2006) are called mechanisms and that this view of mechanisms is different from the one specified above.

^{vi} Hoenig (2017, 44, 49) uses the terms ‘cumulative mechanism’ and ‘mechanism of cumulative (dis-)advantage’ instead of ‘Matthew mechanism’ but in so far as these mechanisms generate Mathew effects, as is repeatedly suggested by Hoenig (2017, 4, 9, 20, 44, 49), all of these terms refer to the social processes of the same kind.

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