Philosophy of Science (2026), **00**, 1–19
doi:10.1017/psa.2026.10276

PSA PHILOSOPHY OF SCIENCE ASSOCIATION
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ARTICLE

Noncausal Connections in Scientific Narratives

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(Received 19 March 2026 UTC; revised 31 July 2026 UTC; accepted 31 July 2026 UTC)

Abstract

Although scientific narratives have often been studied in relation to causality and explanation, not much attention has been given to their noncausal content. This less explored aspect of narratives is addressed here. I argue that colligatory inferences underlie narrative connections and become significant when they help constitute new scientific phenomena from scattered information. Through a sedimentological case study, I identify kinship relations as noncausal connections that provide continuity to changing phenomena without relying on causal explanations. These relations depend on more basic affinities between apparently unrelated phenomena. As I will defend, such connections contribute to a nonexplanatory form of understanding.

1. Introduction

Narratives are typically characterized by their ability to establish causal links between events. For Carroll (2001), causality is the defining property of narrative connections, and it is by presenting these types of relations that we can distinguish narrative from other kinds of prose exposition, such as chronologies or chronicles. In general, this capacity to present causal links is what we expect from most narratives because, as Carroll rightly argues, temporal succession (or, I would add, spatial juxtaposition) does not produce a relation sufficiently close between phenomena to allow us to speak of a narrative, at least according to the common use of the term.

In science, the explanatory character of narratives is closely tied to their causal structure. Currie (2014), for example, points to differences in the complexity of the causal network that narratives can capture, in contrast to causal explanatory mechanisms. Other authors, such as Beatty (2016, 2017) and Ereshefsky and Turner (2020), have shown the importance of narratives for exploring causal dependencies between events, whether to represent the contingent outcomes that other explanatory methods cannot account for or to better understand the relations between causes and effects when there is a lack of knowledge about the way events are linked. Meanwhile, Roth (2017, 2020) develops a type of retrospective causality,

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https://doi.org/10.1017/psa.2026.10276 Published online by Cambridge University Press

a notion that Roth and Beatty (2025) have extended to historical sciences such as paleobiology.

Thus, the explanatory role of narratives depends directly on their causal structure. However, this does not mean that everything in a narrative aims to capture this type of cause–effect connection. Narrative is something more than an explanation: It proves to be a highly versatile methodological tool, capable of accommodating a wide variety of connections through which very different aims of research may be satisfied. Following this idea, in this article, I wish to examine the noncausal relations that constitute a functional part of narratives.

I begin by recalling the basic operations of juxtaposition and colligation that Morgan (2017) defines as forms of narrative ordering (sec. 2). Following Morgan (2022), I will consider colligation to be the basic inference upon which narratives are built, but some development and clarification is needed on this aspect. Colligatory terms are a known topic in the philosophy of history, defining temporal wholes where different phenomena are unified under a common tendency, whereas for Morgan, who sticks to Whewell's original definition, colligatory inferences are at the basis of narrative-making. I will bring these two notions together (sec. 2.1) and then develop Morgan's account in order to argue that colligation becomes relevant to narrative when it serves to constitute new narrative phenomena from dispersed information (sec. 2.2).

Colligatory inferences lie at the core of the narrative connections that I will examine. The latter are kinship relations, which show how, within a changing phenomenon, one phase emerges from the previous one, thus establishing a genetic relation between two events. In practice, kinship connections require the identification of formal affinities between the colligated objects, as I will illustrate through an example (sec. 3) and subsequently develop in more detail (sec. 4). The result of colligation is a continuous and unified phenomenon whose internal connections make its structure visible to the reader. Alongside these relations of kinship and affinity, I will also define relations of spatiotemporal closeness, although I will relate these more to juxtaposition than to colligation.

Having defined these noncausal narrative connections, I then turn to their epistemic function (sec. 5). Because they do not show what causes the evolution of a phenomenon, it is difficult to argue that they fulfill an explanatory function, for depicting a changing phenomenon is not the same as explaining how it came about and what drives its change. I will therefore argue that these noncausal connections support a form of nonexplanatory understanding, which I will develop from Gijsbers's (2013) notion of unification-understanding, although I will need to modify his account in certain aspects in order to adapt it to the case of colligation. This will lead to a conception of noncausal narrative understanding in which, beyond continuity and unification, relations of kinship and affinity are essential for making change visible.

As a preliminary remark, it should be emphasized that it is not my intention to defend the existence of narratives composed solely of noncausal connections; if they exist, they would be a rarity and, in any case, would be embedded in broader investigations in which references to causality are unavoidable. Rather, my aim is to draw attention to the kinds of noncausal connections that generally pass unnoticed in scientific narratives, while at the same time emphasizing their epistemic importance and their contribution to a conception of narrative that goes beyond its explanatory character. On the other hand, although there may perhaps be some narrative

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connections that relate to the family of noncausal explanations (e.g., den Boef and van Woudenberg 2023; Lange 2017), these would appear in such specific domains that they are not of interest here. The noncausal connections I shall consider appear detached from explanation.

2. Colligation and causality in narrative-making

Narrating is a technique for ordering things. This does not simply mean that it arranges elements into a particular order, like chess pieces on a board, but rather that it does so by showing how those elements relate to one another. On this basis, Morgan (2017) distinguishes between two basic forms of narrative ordering: juxtaposition and colligation. Neither of these presupposes that such ordering must follow a temporal thread, nor that the elements must be connected through causal links. Rather, Morgan is pointing to two basic operations through which one moves from disordered and incoherent pieces to the coherent whole that is a narrative.

For Morgan, then, colligation and juxtaposition lie at the basis of the ordering principles through which narratives are constructed. A similar idea can be found in Imaz-Sheinbaum (2023, 16), who speaks of the "basic cognitive and ultimately rational principles involved in the construction of a narrative," which she likewise regards as "principles of organization." These principles are drawn from Gestalt psychology, allowing her to characterize the cognitive foundations of the process of narrative-making. More generally, encompassing these psychological principles, she endorses the idea that "we construct knowledge of past experiences by organizing parts into wholes, thereby giving meaning to otherwise scattered and disconnected experiences" (2023, 17). Thus, for her, narrative ordering ultimately aims, through Gestalt principles, at bringing dispersed parts together into a unified whole, that is, following a colligatory inference.

This is an important point of convergence between Imaz-Sheinbaum and Morgan, for whom colligation lies at the basis of narrative-making. I therefore take the two accounts to be compatible, with the important qualification that, for Morgan, narrative ordering need not be historical, nor even temporal. As we shall see, colligation can therefore serve purposes other than the constitution of temporal wholes, as it does in historiography. Other than that, Morgan's ordering principles—juxtaposition and colligation—are best understood as inferential principles, whereas Imaz-Sheinbaum's are the cognitive principles that underlie those inferences. Together, they constitute two layers of the same process of narrative construction. Accordingly, although I will rely primarily on Morgan to develop my account of noncausal connections, I will also draw on Imaz-Sheinbaum's work where relevant.

Morgan's ordering by juxtaposition concerns making sense of things that, although they may not initially appear related, emerge together in the course of research. Narrative is therefore compelled to make sense of an order that is not immediately intelligible at first sight. It is quite a straightforward form of ordering, especially when understood in terms of relative spatial and temporal ordering. Juxtaposition fulfills an epistemic function within narratives, yet the kind of noncausal connections derived from juxtaposition—relations of *closeness*, as I shall define them—although important in shaping narrative space, do not ultimately constitute an essential

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feature of the narrative because they are shared by chronicles, as well as by other nontextual representational media, such as maps.

More important, and deserving of a more extended discussion, is the type of ordering that arises from colligation. This notion recurs throughout the literature on the philosophy of history (Walsh 1967; Cebik 1969; McCullagh 1978; Kuukkanen 2015), but it also appears in scientific contexts (e.g., Cristalli and Sánchez-Dorado 2021). In its broadest sense, colligation is a form of ampliative inference, already defined by Whewell (1847), whereby different and scattered empirical phenomena are brought together and unified into a coherent whole. It is in this sense that Morgan employs the term in relation to scientific narrative:

> I want to press the use of Whewell's terminology of colligation for two reasons. First as a process (in verb form), colligating involves bringing elements together and binding them together just as narrative-making does; the outcome (its noun form) is equally appealing, for a narrative can be understood as a colligation. (A little care is needed here: while narrative-making in science can be understood as a process of colligating (the verb), not all colligations (nouns) necessarily come from narrative making; for example, the elements brought together could be similar things, bound together in creating a category.) Second, with these two insights of bringing and binding, it is easy to see how the process of colligation can cover the many varied ways in which scientists use narrative to bring together all sorts of different kinds of elements: empirical elements, theoretical arguments and speculative claims. These practices of colligation vary from site to site, and from science to science. (Morgan 2022, 13)

Morgan, while acknowledging that not all colligations are related to narrative-making, conceives narrative as the product of a colligation. This idea will also underpin my arguments concerning noncausal connections. Nevertheless, Morgan's conception of colligation in relation to narrative-making appears, at first coup d'oeil, somewhat different from the ways in which the notion has usually been understood within the philosophy of history. It is therefore worth bringing both conceptions together before presenting my own, on which my study of noncausal connections will be grounded.

2.1. Colligatory inferences and colligatory terms

The term *colligation* in the philosophy of history is undoubtedly more technical and restricted than Morgan's, although in both cases Whewell serves as the main point of reference. Since Walsh (1967, 59ff.; 1974), philosophers of history have spoken of *colligatory concepts* to designate those historical entities that arise from the unification of several related events and occurrences. The Renaissance, the French Revolution, and Khrushchev's Thaw (Kuukkanen 2015, 107ff.) are examples of colligatory concepts, which define temporal wholes: periods characterized by a general tendency or by a set of common features shared among the constituting parts.

These colligatory concepts are closely connected with explanation. The particular actions of historical agents are explained in accordance with the general historical tendency, and in turn, the general tendency itself is explained through those

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particular actions. Walsh (1967, 59) offers the example of Hitler's occupation of the Rhineland: The occupation is explained by expansionist policy, and expansionist policy is itself historically realized, in part, through that occupation. We understand the whole through the parts, and at the same time, we deepen our understanding of the parts when we relate them back to the whole—something like an analytical version of the hermeneutic circle.

Call this kind of explanation by means of colligatory concepts, if you may, *vertical*, in contrast to the *horizontal* explanations that unfold along a causal chain and a temporal line, such as Currie's (2014) narrative explanations in the historical sciences. These two axes of historical explanation are not mutually exclusive, either in science or in historiography. No one would find it strange for the historian to employ causal narratives alongside colligatory concepts. For the scientist, admittedly, the notion of colligatory concepts may appear more unfamiliar, yet they occur in research more frequently than has usually been acknowledged.

Cebik (1969) had already suggested that colligatory terms do not concern human actions alone. More recently, Zeleňák (2026) has referred to the Anthropocene as an example of a colligatory concept in the Earth sciences. This idea makes it possible to highlight the methodological proximity between historiography and the historical-natural sciences. Above all, it opens the possibility that global natural processes, and not only geological periods, could also be considered colligatory concepts, such as the *Cambrian Explosion*, a term through which all the particular processes of evolution and diversification that occurred over a relatively short span of time 541 million years ago are unified, synthesized, and explained. Hence, colligatory terms, as they were originally conceived within historiography, undoubtedly appear in the natural sciences as well, at least within the historical sciences like geology. It is important to acknowledge this while also looking forward to future developments of this idea. However, for the purposes of this article, these are not the forms of colligation that I will examine in relation to noncausal narratives.

Not all colligatory inferences lead to colligatory terms in the historiographical sense. And this is the distinction I wish to make: the colligatory term, on the one hand, and colligation as an operation—the act of colligating—on the other hand. Whereas the philosophy of history has mainly focused on the former, Morgan's concern in scientific narratives is rather with the latter. I do not think this presents any conceptual difficulty; on the contrary, one might say that the colligations that have traditionally interested philosophers of history—those giving rise to colligatory terms—are a particular instance of the more general act of colligation that interests Morgan, which I shall rework for the purposes of my study.

2.2. Colligation as the making of narrative phenomena

If the historiographical notion of the colligatory concept proves too technical and restrictive for my purposes, Morgan's notion ultimately becomes too open-ended. As we have already seen, she relates narrative-making to colligation in Whewell's sense. Yet she also states that there are acts of colligation that do not result in a narrative. This leaves us without a clear criterion for determining when the act of colligating produces a narrative outcome and when it results in something else. Even more ambiguous is her suggestion that in a colligation, "the elements brought together

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could be similar things, bound together in creating a category" (Morgan 2022, 13), as though the product of colligation might itself be a category sometimes. Yet later, she seems to suggest the opposite idea—namely, that the act of "colligating of narrative-making sits in contrast to the making of tables and categories" (2022, 15).

I shall return later to the relation between colligation and classification when discussing narrative noncausal understanding (sec. 5). Even so, I think it necessary to clarify the relation between colligation and narrative in order to understand when the latter may be considered a product of the former. Because I frame this problem as a preliminary step toward identifying noncausal links in narrative, it is perhaps worth clarifying that I conceive colligation as the act through which the different connections of a narrative are constituted, rather than the narrative as a whole. That is, I do not think a narrative is constituted by means of a single colligatory inference; rather, it is a plurality of colligations that ultimately comes to shape a narrative: some of them giving rise to causal connections, others to noncausal ones.

The main idea at the basis of my study is that colligation becomes important insofar as, by relating dispersed parts, it is capable of (re)constructing the new phenomena that build up a narrative. By *phenomena* here I mean events or processes that cannot be directly visualized from the scattered data themselves, nor from their individual interpretation. These phenomena may or may not be historical, but in any case, and for our purposes, they belong to the domain of science. For example, in epidemiological narratives such as those discussed by Engelmann (2022), the new phenomenon may be the routes of contagion and propagation, which are not themselves present in the data. I emphasize this because although the example I shall employ comes from historical geology, narrative colligation in science is not restricted to the historical domain, as Morgan (2017) has already insisted.

The product of colligation will therefore be a new phenomenon that becomes an integral part of the narrative. And this differs from those other cases in which the product of colligation is a category, an idea, or a label under which a set of particular facts is subsumed. Some may wish to approximate my notion to the historiographical colligatory concepts discussed earlier. What I propose, however, does not reach that level of specification: Historiographical colligatory concepts define historical periods characterized by a particular tendency in some social, cultural, or economic respect, with this tendency being explanatory by some particular set of events, as well as explained by them. My point instead is that by bringing together dispersed information, narrative comes to produce new phenomena that not only constitute objects of knowledge concerning the processes under investigation but are also understood as basic constituents of the narrative itself. This is not a period nor a historical tendency under which other events are subsumed and explained. Thus, my conception can ultimately be generalized to other, nonhistorical investigations.

Something important that colligation must provide—and this affects both historiographic and scientific colligation—is a continuity not found in the mere visualization of scattered parts. This is not a new idea; it already appears in Mandelbaum (1977), for whom colligation may result in "successive stages in a single ongoing process" (McCullagh 1989, 68). Imaz-Sheinbaum (2023, 19) also studies the psychological principle of continuity in relation to narratives. But my point is that the phenomenon resulting from colligation is not a merely static state of affairs, like a map of the world. For that, the other narrative operation pointed

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out by Morgan—juxtaposition—would suffice. With colligation, however, the resulting phenomenon is a changing one, evolving through different stages.

And here there is a point worth emphasizing, one previously noted by McCullagh (1989, 68), namely, that colligation bringing about change alone is not sufficient to provide an explanation: "But the processes of historical change which historians identify are not so self-contained. In those processes each stage is often necessary for the occurrence of the next, but it is not sufficient for it. So to understand why each stage occurred it is not enough to refer to the stage which preceded it." As we shall see (sec. 5), this is exactly what occurs in my example. Yet far from constituting a methodological difficulty, for me, it simply means that there are narrative connections whose epistemic function is to provide a nonexplanatory form of understanding.

3. Example: Kinetic evolution of a sedimentary basin

To illustrate noncausal connections in narratives, I shall draw on an example from geology concerning a sedimentary story. We shall see how dispersed geological observations from a particular region are colligated into a historical entity—a sedimentary basin—upon which changes occur over time. I will use the term *kinetic* to refer to the reconstructed phenomenon because, in this almost cinematic, animated portrayal, during the phase of the investigation on which I will focus, causes are not invoked—that is, there are no dynamic considerations yet. When such causes are later referred to, as I shall argue, this occurs by stepping outside the regional historical evolution being described and appealing to global processes.

I will employ the example of the evolution of the Cenozoic Duero Basin (Iberian Peninsula), which I consider representative of these types of sedimentological studies. Schematically, one can imagine an upward-working methodology, moving from local descriptions of materials observed in outcrops to the regional reconstruction of sedimentary environments. While mapping geological materials, a first relation of juxtaposition, which is expressed as connections of closeness between the objects, is first identified. These connections are important to define a narrative space, but juxtaposition appears here just as a step prior to colligating all the information in a unitary and changing phenomenon. In this way, these sedimentary stories originate after an extensive work of correlation and interpretation, through which a regional phenomenon is reconstructed from local data and then colligated.

The sedimentary evolution of the Cenozoic Duero Basin is defined in terms of five sequences separated by disconformities. Each of these sequences is named after the geological age to which it corresponds (Aragonian, Vallesian, Turolian, etc.) and defines particular sedimentary systems, variable over time and space. For what I wish to highlight, I will draw on the synthesis of Alonso-Gavilán et al. (2004), which shows the alternation and variability of the sedimentary environments interpreted from the record. For example, for the middle Aragonian sequence in the Duero Basin, we find the following exposition:

> This [lacustrine system] is composed of mudstone–marl facies, with more carbonate-rich levels at the top and gypsiferous levels in central areas. They represent lacustrine sedimentation developed in the marginal fringes

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> (distal alluvial plain lakes) and in the central parts, where facies of open lakes and others of closed lakes with gypsum are deposited. ... In the eastern domain, the detrital succession, ... characterised by its litharenitic composition, is a braided fluvial system that evolves into a meandering system, prograding over fluvio-lacustrine environments. (Alonso-Gavilán et al. 2004, 554; my translation)

In this example, we first observe a physical description of the materials ("composed of mudstone–marl facies," etc.) and their relative spatial and temporal relations, followed by their sedimentological interpretation ("they represent lacustrine sedimentation," etc.). The materials are first defined, and it is shown how they are juxtaposed. But the content that is properly narrative, insofar as it refers to historical phenomena beyond the empirical data, is the interpreted historical phenomenon. The clearest noncausal colligation between phenomena occurs when the authors describe the "braided fluvial system that evolves into a meandering system, prograding over fluvio-lacustrine environments." Here, the authors are referring to a change in the morphology of the river channels, which also increase in extent (they prograde) relative to the lacustrine systems present in previous stages. There is no reference to why these changes occur, yet the very act of representing this transition is itself of epistemic value to the research.

These relations emerge from the colligation of sedimentary phenomena that at first sight appeared unrelated. Bonded together, they unify in a changing phenomenon the successive stages in the evolution of the Duero Basin throughout the Cenozoic (Alonso-Gavilán et al. 2004, 554–56). Although the stages are clearly delineated by sedimentary disconformities, at the narrative level, what we obtain is a continuous account of the processes operating in the basin: The disconformities do not constitute breaks in the narrative but are themselves narrative elements, equally representative of historical events, specifically, moments when sedimentation paused and previously deposited materials began to be eroded—processes that also form part of the basin's history (Alonso-Gavilán et al. 2004).

Through interpretations such as those of the excerpt, the authors ultimately present a succession of sedimentary environments along a temporal line: sedimentation in paleovalleys, braided channels, distal alluvial plain lakes, swamp-like settings, deltas, and so on (Alonso-Gavilán et al. 2004). In each case, distinct processes are defined as shaping the sedimentary system and providing a picture of that moment in the past, thereby reconstructing the history of the basin in a kinetic way, through successive episodes arranged in continuity. As a visual reference, before the observations are colligated, the basin's history can only be described in terms of seemingly disconnected juxtaposed environments—braided fluvial systems, meandering fluvial systems, fluvio-lacustrine settings, evaporitic environments, and so forth—that may appear to have no relation to one another. After colligating the different environments, we begin to understand how transitions occur from one to another within a single, continuously evolving system.

It must be emphasized that from colligation follows more than a mere temporal sequence. Our example is not a simple chronological succession of the following type: "1685. Revocation of the Edict of Nantes; 1688. Beginning of the Nine Years' War; 1694. 21 November, birth of François-Marie Arouet" (Cronk 2017, 551; my translation).

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Rather, in our succession of sedimentary environments, we see relations between properties that change over time: *braided* systems evolving into *meandering* systems, *lacustrine* settings becoming *evaporitic*, and so forth. In other words, beyond temporal succession, qualitative relations between elements of the narrative are highlighted through changing properties such as channel sinuosity or desiccation of water bodies. Thus, how one system emerges in continuity with a previous phase is depicted through formal affinities from which a process can be extrapolated. For instance, the transition from a lacustrine to an evaporitic system is inferred as a process of desiccation on the basis of features relating to their respective water content.

This is why the connections among sedimentary environments appear closer than other chronological sequences: They are more than mere relations of spatial or temporal closeness, as in chronologies. Instead, qualitative connections allow for the ordering and shaping of a new phenomenon. In the example, the colligation of different sedimentary environments leads to the kinetic reconstruction of the sedimentary basin as a single historical entity. Thus, we come to understand how the environments evolved through a series of changes in sedimentary features such as water content or river sinuosity.

And I say *how*, not *why*. What we understand in this case, once the narrative elements are put together, concerns the transition from one event to another, the way in which an object undergoes change, how one sedimentary system emerges from the previous one, and how these changes occur in a continuous history. For example, in the fragment cited previously, "a braided fluvial system that evolves into a meandering system," the braided system is not the cause of the meandering one. Both are identified as successive phases of the same evolving system; there is a progressive transition from one to the other, as well as a genetic relation, but the causes of this change are not made explicit in the exposition.

Indeed, in the example just presented, the drivers of the evolution of the sedimentary system are outside the basin itself because they relate to tectonic and paleoclimatic processes acting over much larger regions of the globe. Because of the scale at which they operate, these causes are better addressed in other, more general narratives that consider the common causes driving the evolution of the different Cenozoic basins of the Iberian Peninsula, not only the Duero Basin—for example:

> An important stage in the formation of the Spanish Cenozoic basins coincides with the transmission of compressive stresses to the entire Iberian Plate during the Eocene. . . . This stress regime influenced the evolution of the infill of the large interior basins of the peninsula, giving rise to sedimentary successions of considerable thickness and continuous over time, dominated by continental facies (alluvial and lacustrine sediments). (Calvo 2004, 584–85; my translation)

This fragment does capture a causal structure, linking the genesis and evolution of the Iberian Peninsula basins with a compressive tectonic process. However, this concern pertains to a different narrative from that of Alonso-Gavilán et al., and it involves a problem posed within another field of study with a purpose distinct from that which interests us. The text by Alonso-Gavilán et al. offers a detailed interpretation of the sedimentary systems and the way they succeed one another in time and space, so by the end of the exposition, the reader can visualize the processes

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that took place in that basin and understand how they shaped its evolution. Calvo's text, in contrast, seeks to identify the driver of that evolution, to explain the change, but without bringing together all the events occurring within a particular basin; instead, it projects its explanation from a broader perspective. This is what I meant by stating that the causes of the changes are external to the noncausal narrative.

4. Defining noncausal narrative connections

In section 2, I followed Morgan's notion that colligation is the inference underlying narrative, the operation that makes the ordering of material possible. Then, I developed this idea to argue that it is when the product of colligation is a new scientific phenomenon that this inference becomes especially significant for the construction of narratives, beyond the production of labels, conceptual categories, or the colligatory terms from historiography. Through the example discussed in the previous section, I have sought to illustrate the noncausal connections that emerge through this process of colligation.

There are two interrelated notions that I have been discussing under the heading of "qualitative relations," which I shall define more precisely in this section: the *affinities* between colligated objects—that is, the characteristics they share—and their *kinship* relations, namely, how one phenomenon emerges from another. Together, they allow us to trace relations between scattered phenomena to unify them in a continuous entity. To these we may add another type of noncausal connection that, although it may be present in narratives—or at least precede them—does not arise from colligation but rather from juxtaposition. These have been referred to as relations of spatial and temporal *closeness*. As Carroll (2001) has already suggested, these do not establish sufficiently tight relations to consider these connections as a defining aspect of narratives, even when all the events fall under the same subject.

The relations of closeness might appear in the first steps of an investigation like the one in the example: They organize the elements into a paleogeography, and with this description, we can understand how the narrative action will unfold afterward. These relations perform an ordering function in the narrative that is worth highlighting, but they are common in the making of other representational media, such as maps. These relations of closeness appear as a step prior to colligation; they are typical in stratigraphic studies and provide spatial and temporal ordering. But when it comes to phenomena resulting from colligation, the other type of connections must be invoked, which would provide narrative unity and continuity.

Turning, then, to the more substantial part of the discussion—to affinities and kinships—how are they to be defined? *Affinity* refers to the property shared by two phenomena; *kinship* is the genetic relation derived from colligation in which one phenomenon is recognized as having emerged from another, as its development or evolution. The thing is that we need to first identify the affinities to figure out a kinship connection, so in practice, both appear interrelated as part of the same colligatory inference. On the other hand, affinities do not always establish kinship connections, but in these cases, the result of a colligation is hardly ever a continuous narrative but rather a classification or a qualitative correlation.

How, then, do kinship connections occur in narrative—that is, what is it that is being connected and ordered? I just said that, for what it is worth here, kinship

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relations arise between phenomena that share a common feature from which a process can be extrapolated. In the example I gave, the difference in the water content between a lacustrine environment and an evaporitic environment is one of the features through which colligation is made between the two sedimentary settings. From this colligation, a process of desiccation is extrapolated, showing an evaporitic system to be the evolution of a lacustrine one. In other words, the first environment is connected to the second through a qualitative feature (water content), which is used to demonstrate their historical kinship via a process (desiccation). In sum, what is being bound together are two different manifestations of the same qualitative feature, such that both are unified under a single process. Following my notion of colligation, we can see the emergence of a new phenomenon from two particular observations.

In a sense, this already seems to presuppose continuity, and for the type of colligation that I have considered, I have already indicated that both go hand in hand. However, it should be stressed that there could be a colligation without any continuity between the elements. This brings to mind Morgan's (2017, 88–89) example of Pieter Bruegel the Elder's painting *Children's Games*. In the painting, there are different groups of children at play, and although these games can be colligated so as to yield the general idea that holds the painting together, on closer inspection, "each little group is an island unto itself, there is no interaction" (Morgan 2017, 88).

In other words, although there is a shared feature that allows each of these groups of children to be bound together, there is no continuity between them, even after their colligation. This would then be a case in which relations of affinity are present, but they do not give rise to kinship connections. Furthermore, we can see that there is no continuity because colligation is not giving rise to a new phenomenon in the sense in which I have employed the term. In contrast, Bruegel's children are colligated under an idea in such a way that the product of the colligation is little more than an abstraction of what each particular element has in common.

This does not happen in Lynd and Lynd's narrative *Middletown*, which Morgan (2017, 89) mentions following the example of Bruegel, and which constitutes "an urban sociological-anthropological study of a middle American, mid-sized town in the 1920s." Here, different aspects of American society are colligated into an organic whole. The product of the colligation reveals the structure and characteristics of that society at a particular historical moment by showing how the different elements interact with one another so as to provide a comprehensive picture of its functioning—something that could not be understood by considering each of its parts in isolation.

My example is more akin to *Middletown*'s narrative. In the way the sedimentological changes succeed one another, one can discern a guiding thread that provides cohesion and unifies the exposition. Although I do not want to dive deep into this discussion, this would mean that the continuity provided by kinship connections has an ontological significance that is not found in examples such as Bruegel's, where unification appears more related to categorization. In my example, a historical entity (the Duero Basin) is reconstructed and serves as the axis of the unfolding events. The different phases are related to one another according to the changes experienced by that entity, from an initial state at the start of the basin's infill to the cessation of sedimentation at the final phase.

What the colligation of narrative phenomena is doing is constituting the very entity that corresponds to the Hullian central subject of the narrative (Hull 1975).

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In Hull's conception, central subjects have a unifying character for the elements of the narrative, and he suggests that these central subjects constitute a narrative property more primitive than causality—in this, Hull's conception contrasts with Carroll's. Indeed, Hull seems to explore the idea that causal relations are not the only ones established in a narrative if we read what he says here about causality: "The main sort of continuity and unity envisaged so far by philosophers for historical narratives has been causal" (Hull 1975, 255), in contrast to what he says shortly afterward on central subjects:

> Central subjects afford the basic unity and continuity of the historical narrative. Any additional unity and continuity supplied by the narrative is not just secondary to the more fundamental unity and continuity of the central subject but derivative of it. (1975, 255)

Taken together, these two references clarify another, earlier observation of Hull's: "Unity is provided not so much by the connections between the events related as by the unity and continuity of the historical entities" (1975, 254). Considering the first quote about causality, in this last quote, it seems that by "connections," he is referring only to causal ones. In short, if we adopt a criterion like Hull's to delimit what makes narratives distinctive—that is, what differentiates them methodologically—we do not necessarily need to appeal to causal connections to preserve unity and continuity; it suffices to define the connections constituting an entity that persists over time through a series of changes.

This idea may be better grasped if we draw an analogy with a literary narrative with a similar noncausal structure as ours. André Breton's (1928) *Nadja* provides an interesting example. The work consists of scenes, descriptions, and philosophical reflections, among other materials that might appear more or less fragmented and detached. Even the encounters between the narrator and Nadja, the main character, do not constitute a conventional causal plot; instead, they occur as chance meetings in the streets of Paris, leading to conversations on various topics. Of course, causal references are also present in the narrative, explaining some particular events, but in the overall structure of the work, they recede into the background.

That the narrative appears causally unstructured does not mean it lacks unity and continuity because all (or the relevant part) of the content is presented to help reconstruct Nadja's personality; by linking these disparate scenes and more or less scattered reflections, we try to understand the character better—there is still an air of mystery surrounding her at the end, but that is a literary device in any case. Ultimately, we try to answer the question "Qui est Nadja?," which is made explicit in the narrative and in the accompanying visual material, serving as the guiding thread of the plot. Through that question, the content of the narrative appears connected and unified.

In both cases—the *Nadja* example and that of the Duero Basin—the unifying subject operates like an implicit or explicit question, and from it derives an organization of information within the narrative that allows us to understand something we could not grasp by considering each element separately. In *Nadja*, we understand the protagonist's personality, which does not emerge from the

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individual scenes alone; in the Duero Basin, we reconstruct its kinetic evolution, which cannot be understood by considering the sedimentary phases in isolation.

Continuity is essential for arguing what makes noncausal narrative connections distinctive. For Hull, the defining feature of narrative lies in the continuity that cannot be provided by the mere contemplation of dispersed parts. This means that any connection that is to be regarded as genuinely narrative must provide such continuity, regardless of whether or not it involves causality. In this respect, Hull's insight is more fundamental than Carroll's claim (2001, 121) that the defining feature of narrative connection is causality. We may therefore define noncausal narrative connections as those derived from a colligatory inference that enable us to bring together scattered information into a continuous changing phenomenon, but without causal references. This includes kinship connections grounded in relations of affinity, but it excludes relations of spatiotemporal closeness, which order the information in a way more akin to that of chronicles.

5. Narrative understanding without explanation

The noncausal connections we have considered are not explanatory; they do not tell us why phenomena occur or what drives their change. Rather, what they do is constitute a unitary phenomenon out of its fragments, giving continuity to scattered observations and showing their genetic relation. In doing so, they lead to an understanding of the phenomenon that, although detached from causal explanation, nevertheless has epistemic value. However, we cannot be content with a vague notion of understanding; we must clearly define the type of understanding to which we are referring. Only then can we highlight the epistemic function that this type of noncausal connection plays in the narrative and assert its importance.

In the philosophy of history, the cognitive function of narratives and their relation to understanding has been recognized at least since Mink (1987), who argued that narratives provide a form of understanding distinct from that offered by scientific explanations. Even so, the cognitive function most often emphasized in narratives has usually been tied to the causal relations between historical events (Stueber 2015). Prescott-Couch (2025) has challenged the view that the essential epistemic function of narratives is tied to causality; however, his notion of narrative understanding is linked to a form of practical knowledge, which, in broad terms, refers to the narrator's ability to elicit certain responses from the reader. Such a function, however, can hardly be extended beyond the domain of the social and political sciences.

With the work of Imaz-Sheinbaum (2023), narratives are explicitly connected to the notion of understanding developed by authors such as Elgin (2007), de Regt (2009), and Khalifa (2017). For her, understanding in narratives is regarded as a practical skill that allows one to "take different pieces of information and construct coherent meaning from them" (Imaz-Sheinbaum 2023, 93). Therefore, for Imaz-Sheinbaum, understanding is the practical ability of putting together scattered pieces of information into a coherent whole. As I noted in section 2, this is a process of colligation, so it is easy to build a bridge between both ideas.

Now, Imaz-Sheinbaum's later development focuses on the epistemic evaluation of narratives (2023, 105–106), rather than on the distinction between different forms of understanding that is my concern here. To address this latter issue, we must turn to

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more specific developments in the literature on scientific understanding. Among these accounts, much of the literature has focused on explanatory understanding. Particularly notable is the work of de Regt (2017), who begins by examining the unificatory understanding associated with the Hempelian model and the causal understanding provided by explanatory mechanisms (48ff.), before going on to develop his own general account of explanatory understanding in science (88 ff.).

Although de Regt accepts from the outset that other nonexplanatory forms of understanding may coexist with his account (de Regt 2017, 2, footnote 1), other authors have defended the stronger thesis that there is no understanding without explanation (Strevens 2013), or at least that explanation is the ideal of understanding (Khalifa 2013). The latter idea is compatible with my further development: Whereas Khalifa states that explanatory understanding is the final aim of any research, what I want to emphasize is the epistemic relevance of nonexplanatory understanding in certain scientific practices. He is interested in the final outcome of research, whereas I focus on the stones that pave the way to that outcome. As for the strong thesis of Strevens (2013) according to which understanding collapses into explanation, this idea is not widely held, and several authors have defended positions in which understanding is detached from explanation, including Berger (1998), Lipton (2009), Gijsbers (2013), and Baumberger et al. (2016).

Among these latter forms of nonexplanatory understanding, I will focus on what Gijsbers (2013) calls *unification-understanding*. This is a form of nonexplanatory understanding that is not grounded in causal references and instead centers on the unification of phenomena through relations of kinship. One of the things Gijsbers wants to emphasize with his notion of unification-understanding, in contrast to explanatory understanding, is that it is possible to achieve understanding and knowledge of a given phenomenon even when the causal relations between its elements are unknown:

> So one could know of all the phenomena in the universe that they occurred, and yet not understand why any of them occurred—the causal connections between the phenomena being an additional layer of knowledge not implied by the phenomena themselves. (Gijsbers 2013, 521)

His definition of unification-understanding is grounded in this idea, where relations of kinship are considered during the classification of phenomena, which is explicitly demarcated from explanation: "The difference between explanation and successful classification lies in the type of connection they uncover" (Gijsbers 2013, 521). A few remarks are needed before seeing how this notion relates to noncausal connections in narratives, though.

First, it should be noted that by *unification*, the author does not mean the same as the understanding derived from Hempelian explanation, which brings together—unifies—phenomena governed by the same law (de Regt 2017, 71ff.). Rather, it involves bringing together phenomena or objects that stand in relations of kinship through shared features. Second, it should be noted that Gijsbers's kinship relations are considered in processes of classification, rather than in the colligation of information into a new phenomenon. He is referring solely to biological and taxonomic kinships, not to any emergence of a phenomenon from a previous state of

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affairs, as in my case. Therefore, in order to adapt Gijsbers's proposal to my study, I will need to return to the tension that I left unresolved in section 2, between colligating and classifying.

For Gijsbers, this unification-understanding arises in noncausal classifications, such as in taxonomic biology (2013, 519). But a narrative cannot emerge from the mere activity of classification alone, as Morgan has noted (2022, 15). The relation between colligation and classification is not always clear. We have seen that sometimes, Morgan ambiguously considers categories as the product of a colligation. In the historical sciences, McCullagh (1978) already revised this tension between colligating and classifying in the works of Walsh and Dray. The product of classification had been understood as a general category—for example, the Russian Revolution, the French Revolution, the Carnation Revolution, and so forth can all be classified under the general category of "revolution" defined by the relevant characteristics shared by all particular events. The product of colligation, by contrast, is always a particular event—*the* Russian Revolution, *the* French Revolution, and so forth. However, for McCullagh (1978, 271ff.) colligation can also result in general concepts and is therefore a form of classification.

Although it is perhaps true that colligation requires a certain notion of classification in order to identify affinities between phenomena and bring them together, my treatment of colligation does not require an investigation of this aspect; nevertheless, what McCullagh says can help clarify Morgan's ambiguity regarding the relation between colligation and classification. Moreover, whatever the reader's position might be regarding this, in order to relate my account to that of Gijsbers, I do not see it as necessary here either to argue that the colligations I have defined are instances of classification or that they are independent of it.

This is because what I wish to defend is not that noncausal connections are the product of a classification like that analyzed by Gijsbers. My focus is on colligation, not classification. What I want to emphasize instead is that if my notion of noncausal connection derived from colligation and Gijsbers's notion of classification are both based on kinship relations, then a parallel should be possible between the kind of noncausal understanding that arises in each case. After all, Gijsbers's classification and narrative colligation share two essential attributes: (1) They exhibit independence from causality and explanation, and (2) they aim to order and bring dispersed elements together. For this reason, I do not believe any reservation regarding the differences between colligating and categorizing poses an obstacle to my present concerns.

For Gijsbers, understanding does not arise from discerning a differentiated category of objects but from recognizing the relations that unify those objects into a group while distinguishing them from others. A student of paleontology may know that there are different orders of ammonoids and visualize this division, but if he does not understand the characteristics that relate the members within a group and those that demarcate each group from the rest, he gains no understanding: For him, the groups are nothing more than empty sets with a label. The point here is that for Gijsbers, understanding arises from attending to the affinities that exist between individual terms, not from merely visualizing the outcome of that activity—the categories themselves, whose content may remain opaque. Knowing that categories

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exist is not the same as understanding the relations that constitute them as categories, and it is only this latter awareness that opens the door to understanding.

Thus, understanding arises from unification, which in turn derives from the identification of affinities that allows us to postulate kinship relations, rather than from the creation of a new category or classification. In the same way, when colligation unifies information in order to constitute a new phenomenon, our understanding of that phenomenon does not stem merely from visualizing it as a whole. Rather, it comes from grasping that whole through the kinship relations by means of which the phenomenon has been constituted. This means that noncausal relations of kinship lie at the basis of our understanding of the complex phenomena reconstructed in narratives: It is through these connections that the internal structure of the phenomenon becomes visible to us and that we understand how its parts relate to one another. We understand it as a unified whole, certainly, but we would not attain that understanding if we were unable to trace the internal connections that constitute the phenomenon.

This becomes especially evident in a case such as ours, where the kinematic evolution of a phenomenon is reconstructed. The transition from one phase to another in the history of the sedimentary basin is made visible through changes in certain characteristics—as I have already indicated: changes in water content through which the transition from a lacustrine to an evaporitic environment is visualized or changes in the sinuosity and extent of fluvial channels, alongside other events such as episodes of nondeposition and erosion, and so on. In other words, beyond visualizing the phenomenon as a whole, understanding its change involves understanding those qualitative affinities through which relations of kinship are established.

Because I argue that what provides understanding is not only unification but also the kinship connections that underlie it, it may be more appropriate to call my account *kinship understanding* rather than *unification-understanding*. But whatever label we use, that is the core idea: Kinship connections provide understanding by making it possible to trace the qualitative features that undergo change, thus allowing us to visualize how one state of affairs emerges from the previous one. While this unifies the phenomenon, it also provides insight into its internal structure. Moreover, although we understand how one phase arises from the previous one, we do not understand what drives that change: There is neither causal nor explanatory understanding of the processes, only a qualitative account of the changing phenomenon.

Although I consider kinship connections to be the main source of noncausal understanding in narratives, it is also worth drawing some attention to another idea raised by Gijsbers that can be illuminating to our aims. After developing his notion of unification-understanding, the author also touches on the idea of a possible spatiotemporal form of understanding, although he stops short of claiming it as a distinct type of understanding:

> Perhaps those connections between the phenomena that position them in space-time (e.g., the connections "later than," "earlier than," "right next to," "far away from," "at the same location," and so on) also correspond to a type of understanding. Understanding that and how the phenomena combine to form a

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> single space and time, a single world, is a step up from just having a myriad of unconnected impressions. (Gijsbers 2013, 521)

Here, Gijsbers is referring to relations of spatiotemporal closeness, such as those that, as I said, may also appear at a prior stage to narrative colligation. There is no doubt that organizing the elements helps us understand their relative positions and sets the stage for studying the affinities that underpin kinship relations. What seems to lead Gijsbers to be hesitant about treating this spatiotemporal understanding as a distinct form of understanding is that it also involves unification, so this spatiotemporal understanding would appear to be a particular instance of his unification-understanding. However, as I have argued, it is what underlies unification that ultimately provides understanding. Kinship relations are one such case; relations of closeness are another. In this second case, narrative elements are juxtaposed in the same way as they would be on a map, and that certainly improves our understanding compared with a previous "myriad of unconnected impressions."

Thus, if one were to draw a line between the two forms of noncausal understanding in narratives, I would place it precisely in the way the unification occurs: Unification by closeness relations only requires moving the narrative elements through time and space to arrange them in a given order. By contrast, unification by kinship is not limited to placing things in time and space; it also highlights the relationships between specific properties intrinsic to a changing entity. This latter form of understanding also helps to demarcate the epistemic value of narrative-making from other types of ordering, for although a narrative without causes can be conceived, it is more difficult to imagine a narrative without change, without evolution, a static story.

6. Conclusions

Noncausal connections in scientific narratives play a significant role in the organization and construction of phenomena. They do not contribute to narrative explanation like the causal structures pointed out in previous literature, but they can be important in a phase preceding the investigation of causal links between events. They contribute to a noncausal understanding of historical processes, organizing and bringing together information that appears dispersed during research.

By taking these types of narrative connections into consideration, we open up a different perspective on narratives, one that goes beyond causal structure and explanation. Like Morgan, I conceive narratives as techniques employed to satisfy different aims of the research. Explanatory conceptions of causal narratives can divert attention away from connections that fulfill other epistemic aims in relation to understanding. For this reason, by insisting on noncausal connections as constitutive and functional parts of the narratives, I reinforce a conception that seeks to capture all the epistemic advantages of this scientific practice.

Acknowledgments. I am grateful to María Caamaño Alegre, with whom I discussed an earlier draft of this article and who provided valuable suggestions. I also thank the two anonymous reviewers for their helpful comments.

Funding Statement. None to declare.

Declarations. None to declare.

https://doi.org/10.1017/psa.2026.10276 Published online by Cambridge University Press

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Cite this article: Álvarez Arias, Saúl. 2026. "Noncausal Connections in Scientific Narratives." *Philosophy of Science*. https://doi.org/10.1017/psa.2026.10276

https://doi.org/10.1017/psa.2026.10276 Published online by Cambridge University Press