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Location of inertia and inertial mechanisms: spatial concepts for information systems-enabled organizational transformations

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LOCATION OF INERTIA AND INERTIAL MECHANISMS: SPATIAL CONCEPTS FOR INFORMATION SYSTEMS-ENABLED ORGANIZATIONAL TRANSFORMATIONS

Research Paper

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Abstract

While an abundant literature describes what, when and why organizational inertia impedes Information Systems-enabled Organizational Transformations (ISOT), the question of where inertia lies and how it is reproduced received scant attention. These questions are all the more important as emerging digital technologies such as AI, data analytics or blockchain fuel new waves of transformations and tie organizations' transformation dynamics to external platforms, algorithms, gig workers or partners. This paper introduces two new concepts, namely the location of inertia and types of inertial mechanisms, as the foundation for a spatial approach to inertia. This approach aims to better locate inertia and what underlying mechanisms reproduce it. We also discuss how these concepts can advance our understanding of ISOT and how they could further be developed into a broader theory.

Keywords: organizational transformation, organizational inertia, location of inertia, inertial mechanism, spatial approach

1 Introduction

Since the seminal work of Hannan and Freeman (1984) and Venkatraman (1991), the difficulties of undertaking Information Systems-enabled Organizational Transformations (ISOT) remained a persistent challenge in practice and an enduring theoretical puzzle for scholars. To describe organizational proneness to rigidity, research often relied upon the concept of inertia, a force that maintains an organization on its current tracks and prevents its transformation until a more important force of change is applied (Besson and Rowe, 2012).

Inertia as a concept originates from population ecology (Hannan and Freeman, 1984) and spread in organization studies through punctuated equilibrium (Tushman and Romanelli, 1985; Romanelli and Tushman, 1994; Gersick, 1991), institutionalist (Meyer and Rowan, 1977; DiMaggio and Powell, 1983) or strategic management theories (Rumelt, 1995). Over the years, it gained increasing attention from IS researchers (e.g., vom Brocke *et al.*, 2020; Schmid, 2019; Besson and Rowe, 2012; Polites and Karahanna, 2012). This literature shares the baseline assumptions that inertia is a fundamental property of organizations and represents a major challenge in ISOT. It also reveals the multidimensional nature of the concept (e.g., Besson and Rowe, 2012; Gilbert, 2005) and the variety of levels it can be analyzed at (e.g., Polites and Karahanna, 2012).

This variety is even more apparent in modern ISOT. Not only do emerging technologies such as AI, big data or natural language processing fuel a new wave of organizational transformations (e.g., Mikalef *et al.*, 2021; Cenamor *et al.*, 2019), but these transformations now span and produce effects well beyond a single unit or level of analysis. Their unintended consequences on individuals, organizations and societies motivate calls to analyze them at a broader level (e.g., Hinings *et al.*, 2018; Majchrzak *et al.*, 2016; Loebbecke and Picot, 2015; Córdoba and Midgley, 2008). At the individual and group level, new forms of inertia, for instance related to overconfidence in models, assumptions and data that are embedded in data analytics tools seem to appear (Gligor *et al.*, 2021; Audzeyeva and Hudson, 2016).

As organizations increasingly mobilize external stakeholders such as customers, digital services or gig workers to support their transformations, this coupling to their environment shapes their future dependencies. In other words, organizations' have to manage new and multiple sources of rigidity, often out of their direct control, to undertake their transformations.

Although organizational inertia ultimately is a property of organizations, its manifestations can drastically differ depending on what specific structure of the organization or its environment is primarily affected. We argue that we are not fitted with the conceptual tools to account for where inertia lies and what exactly reproduces it. While much has been written on the nature of inertia (the *"what"* and the *"why"*) or on the processual dimensions of ISOT (the "*when"*), *where* inertia is located and *how* underlying mechanisms reproduce it have not received the same attention. These questions are particularly relevant to ISOT. If the increasing reliance on external technologies and actors (Winter et al., 2014) affects organizations' rigidity, tools are needed to analyze how it affects inertia and transformation dynamics. In addition, the ability to identify adequate managerial responses also largely depends on our ability to understand where such action is best carried out. Lastly, we believe the question of where inertia lies can help researchers to consider alternative explanations or to explain conflicting results. In this paper, we thus seek to address the following question: how to account for which parts of the organization and its environment contribute to organizational inertia and how it is reproduced?

To address this question, we introduce two key concepts for a spatial approach to inertia that would help address this gap, namely the *location of inertia* and *inertial mechanisms.* These two concepts facilitate a more precise analysis of where organizations' inertia is located and help to avoid conflating all inertia at a generic organizational level and to identify better-targetted organizational responses. Before introducing these two spatial concepts, we set our theoretical background. We first introduce the main streams of research that contributed to theories of inertia, review some key recent developments of the concept and clarify key theoretical differences with the more widely-used concept of resistance to change. We then introduce our spatial approach to organizational inertia and its two key concepts. In a last section, we discuss the limits of our theoretical proposal and outline how these two concepts can support the development of a broader IS theory of ISOTs that would account for their multilevel breadth.

2 Theoretical background

The spatial concepts we introduce in this paper rest on both seminal and more recent theoretical grounds. Inspired by Leidner's (2018) approach to broad theorizing reviews, we synthetize and describe this literature to lay the foundations for further theorizing. This synthesis aims to be integrative in the sense that it strives to "integrate previous knowledge that was dispersed in the literature" so we can then "fill a gap by introducing new or previously unconnected constructs" (ibidem:561). We thus briefly review both the major streams of research on organizational inertia and the more recent theoretical developments we build upon. Because the great variety of approaches to inertia can fuel misunderstandings, we then formally outline key tenets of inertia theories through a comparison to the more-widely used concept of resistance to change.

2.1 Brief history of the concept of organizational inertia

Four major streams of research offered important contributions to theories of inertia at very different levels of analysis. We briefly introduce these streams, namely, population ecology (Hannan and Freeman, 1977; 1984) and situated change (Orlikowski, 1996; Feldman and Pentland, 2003) as two different branches of evolutionist theories, punctuated equilibrium (Gersick, 1991; Tushman and Romanelli, 1994) and institutionalism (Meyer and Rowan, 1977; DiMaggio and Powell, 1983).

The first and perhaps most foundational work on organizational inertia was the population ecology perspective of Hannan and Freeman (1977). Population ecology argues that because organizations institutionalize patterns of action that enabled their past efficiency, reliability and reproducibility in their core structures (Hannan and Freeman, 1984), they are characterized by their "structural inertia" and can

hardly transform. Inertia is then seen as both a byproduct of survival and a cause of future death since it prevents organizations from keeping up with the pace of environmental change. In this perspective, variations thus mostly occurs at the population and community levels through processes akin to natural selection (death of the unfit). Situated change perspectives for their part explored the same key ecological idea of adaptation and selection, but their focus on the level of organizational routines (Orlikowski, 1996; Feldman and Pentland, 2003) led them to the contrasting conclusion that change is in fact widely present in all routines of an organization. This difference leads to very different views of what organizational transformation is. Population ecologists would argue that minor changes in routines by no means are a fundamental transformation that alters core structures of an organization. On the contrary, situated change researchers would retort those transformations occur precisely through the cumulation of many minor changes.

Punctuated equilibrium theories for their part favored another route and devoted their attention to how organizations can fundamentally alter their core structures to overcome inertia (Gersick, 1991; Tushman and Romanelli, 1996). The core idea in punctuated equilibrium theories is that organizations live through periods of stability where inertia makes them efficient until a radical environmental change makes it a threatening liability and forces them to transform in order to survive. Unlike population ecology, punctuated equilibrium theories posit that through strategic and managerial action, change can also occur through the lifetime of an organization. This stream thus naturally seeks to understand why some organizations manage to overcome inertia while others fail.

The institutionalist stream represents a fourth major contributor to theories of inertia, and sought for explanations to why organizations tend to persist in their current and mostly isomorphic forms. Their key contribution was to highlight the role of a legitimacy rather than business-oriented rationality (DiMaggio and Powell, 1983; Meyer and Rowan, 1977). The influence of environmental norms on the organizational level then acts as barriers that hinders transformations and explains organizations' isomorphic tendencies. When taken together, the contributions of these streams highlight the need to account for a) various levels and units of analysis and b) how inertia at one level may stem from another.

2.2 Relativist approach to "core" features and diversification of levels of analysis

From these theoretical foundations, three key and more recent developments advanced the concept of organizational inertia. A first major development lies in the move to relative approaches to core features of an organization; in other words, to where organizational inertia lies. Inertia has originally been viewed as "structural" (Hannan and Freeman, 1984) because it is imprinted in the organization's "deep structure" (Gersick, 1991) through institutionalized patterns of action and cognition[1]. Products, markets and technologies, the distribution of power, organizational structures or the nature, type and scope of control systems have typically been put forward as its key components (Tushman and Romanelli, 1985; Audzeyeva and Hudson, 2016; Hannan and Freeman, 1984). However, the centrality of these features has been questioned to favor more relative approaches to inertia. Elements that lie at the core of an organization's deep structure may indeed very well be peripheral to another, leading to relativist definitions of core structures' transformation "in terms of the additional subsequent unplanned changes that need to be implemented as a result of the initial change attempt." (Dobrev *et al.*, 2003:268). This relativist approach to the deep structure implies that what constitutes the core elements of an organization largely depends on the case and the level of analysis under scrutiny. In other words, there is no universal place to look for organizational inertia.

The diversification of analyses represents a second key development of theories of inertia. Following Hannan and Freeman (1977), population ecology focused its efforts on the population and community

1 Gersick (1991:15) defines the deep structures as a largely implicit " network of fundamental, interdependent 'choices', of the basic configuration into which a system's units are organized, and the activities that maintain both this configuration and the system's resource exchange with the environment."

levels (Hannan and Freeman, 1984). Conversely, punctuated equilibrium theories centered their analyses on the organization and its adaptation (as opposed to selection) as a research problem (Tushman and Romanelli, 1985; Gersick, 1991). More recently, the IS community undertook research at the subunit (Richet *et al.*, 2016; Audzeyeva and Hudson, 2016) and individual (Polites and Karahanna, 2012) levels to understand how they contribute to organizational inertia. Research thus progressively diversified level of analysis from populations of organizations to organizations, then to the collective and individual roots of inertia.

2.3 Multidimensional approaches to the nature of inertia

These inquiries at finer-grained levels initiated a shift from the unidimensional, structural inertia of Hannan and Freeman's seminal work to multidimensional (Rumelt, 1995; Gilbert, 2005) conceptualizations, based on the idea that "there can be no simple theory of inertia as its causes are multiple and varied" (Rumelt, 1995:2). The most formalized typology distinguishes psychological, socio-cognitive, socio-technical, economic and political inertia (Besson and Rowe, 2012). Psychological inertia comes from the perception of a threat (e.g., Bhattacherjee and Hikmet, 2007), fear of change, aversion to ambiguity or conservative attitudes (e.g., Hirschheim and Newman, 1988; Kim and Kankanhalli, 2009). Socio-technical inertia for its part stems from the routinization of activities that reinforces the stability of skills and processes (Levitt and March, 1988), which can then be ill-suited to the introduced technologies (Gilbert, 2005; Lyytinen *et al.*, 2009). Socio-cognitive inertia rather stems from bounded rationality and conformity bias (Hirschheim and Sabherwal, 2001; Rumelt, 1995), from rigid analytical frames, cultures and values (Tushman and O'Reilly, 1996), or from mismatches between different organizational subcultures (Jackson and harris, 2003; Smolander and Rossi, 2008), old and new analytical frames (e.g., Hughes *et al.*, 2001; Mangan and Kelly, 2009), or organizational culture and technology (e.g., Cooper, 1994). Economic inertia manifests through difficulties in reallocating resource, for instance because of sunk or switching costs (Pfeffer and Salancik, 1978; Gilbert, 2005) or resource monopolization by either exploitation or exploration processes (Lavie and Rosenkopf, 2006). Lastly, political inertia is the result of group or individual opportunistic behaviors (Markus, 1983; Clemons *et al.*, 1993), alliance rebuilding costs (Besson and Rowe, 2012), conflicts between diverging interests or conflict avoidance strategies (Jarvenpaa and Ives, 1996; Smolander and Rossi, 2008).

2.4 Clarifying key elements of the concept of inertia through a comparison with resistance to change

Over time, these various developments yet fueled confusions, inconsistencies and a lack of conceptual clarity in the analysis of inertia (Schmid, 2019; Polites and Karahanna, 2012). The concept is often used to describe the more widely used resistance to change (e.g., Pardo Del Val and Martinez Fuentez, 2003) to the point the latter is sometimes used as a definition of the former (e.g., Haskamp *et al.*, 2021). While resistance to change is the most documented form of inertia (Schmid, 2019), the two concepts rest on very different conceptual foundations. In the following, we use a comparison between these two concepts to more clearly and simply outline the theoretical basis for a spatial approach to inertia.

Firstly, organizational inertia differs through its broader scope of analysis. Resistance is mostly approached as a psychological attitude or a behavior (Lapointe and Beaudry, 2014). As an attitude, it corresponds to psychological inertia and rests on the same underlying phenomena such as anxiety (Tushman and Romanelli, 1985), conservative attitudes (Hirschheim and Newman, 1988; Kim and Kankanhalli, 2009) or the perception of a threat (Bhattacherjee and Hikmet, 2007). In a political sense, resistance is a conscious behavior to defend the interests of an individual or a group against a perceived threat (Markus, 1983). However, unlike resistance to change, political inertia may also result from disagreements between promoters of the transformation or from an inability to question prior alliances. Furthermore, encompassing socio-technical, socio-cognitive or economic forms of inertia further broadens the scope of analysis.

Secondly, while the collective organization of resistance to change (Lapointe and Rivard, 2005) or resulting organizational consequences (Markus, 1983) can be analyzed, resistance is mostly approached at the individual level because of its psychological roots or individual motivations. Conversely, the diversity of levels of analysis in the study of inertia was acknowledged in early research (Hannan and Freeman, 1977), thus allowing analyses at the individual, group, organization or environment level.

A third fundamental difference between inertia and resistance to change lies in their relationship to transformation. Because it manifests through an opposition to change, resistance by definition is a reactionary force. By contrast, inertia is a conservative force that does not necessarily result from opposition to change but rather tends to reproduce what exists. This difference entails two consequences that relate to the origins and the consequences of inertia. Resistance being a byproduct of change, change is a necessary condition for resistance to exist. Inertia for its part exists in the deep structure of the organization prior to change (Besson and Rowe, 2012) and is only revealed by the inability to transform. As a consequence, research on resistance often approaches it as a negative phenomenon that should be fought, or as potentially positive if change is deemed bad (Hirschheim and Newman, 1988) or if resistance leads to improving it (Lapointe and Rivard, 2005). In contrast, inertia creates a double paradox. It is not fundamentally good or bad. It is inevitable for it allows organizational reliability, reproducibility and performance (Hannan and Freeman, 1984), but hinders transformations. Second, contrarily to resistance that disappears or diminishes sufficiently for the transformation to be carried out, inertia persists under a different form and can impair future transformations since transforming involves institutionalizing new patterns of action and cognition (Dobrev *et al.*, 2003; Rumelt, 1995).

A fourth major difference lies in the different roles of structures and individuals in theories or inertia and theories of resistance to change, that is, in their approach to causal autonomy (Markus and Rowe, 2018). As a behavior, resistance to change is the result of an intention. The resisting actor is explicitly or implicitly guided by a subjective rationality that determines whether they accept or reject change. While inertia can also result from actors' conscious behaviors, its analysis is centered on the influence of structures. For this reason, it often results from unintentional or unconscious phenomena such as the influence of habits and routines on behaviors (Polites and Karahanna, 2012), of collective analytical frameworks on cognition (Utesheva *et al.*, 2016) or of economic rationales that are independent from actors' present choices (Gilbert, 2005).

Lastly, these two concepts differ through their motors, that is, the mechanisms that reproduce them. Resistance is a product of a gap between the transformation and expectations; between a desired reality and an anticipated future. Inertia is for its part self-reinforced through two fundamental mechanisms. On the one hand, the routinization of action and cognition into established patterns along with the learning effects they produce contribute to reproducing existing structures through repetition. Furthermore, for an organization to be a cohesive whole, these norms of action and cognition are reinforced by a set of interdependencies between organizational structures (Gersick, 1991:13). We summarize these various elements in table 1 below.

	Resistance to change	Organizational inertia
Scope of analysis	Narrow: political behaviors and their psychological roots	Broad: psychological inertia; broader approach to political inertia and other forms (socio-cognitive, socio-technical, economic).
Level of analysis	Mostly micro: individual political behaviors and their psychological roots; can include collective resistance to change.	Can be analyzed at all levels (individual, routine or task, group, organizational, environment…)
Relationship to change	Necessarily opposed to change	Does not necessarily result from an opposition to change
Origin	Originates from change, which is a necessary condition to resistance.	Consubstantial to organizing. The transformation only reveals inertia that exists prior to it.
Consequences	Often negative; positive when the transformation is bad or when resistance improves it (Lapointe and Rivard, 2005).	Paradox of inertia: inertia is both a condition for performance and a threat when transformations are required.
Causal autonomy	Intentional, voluntaristic	Can result from an intention but social and technological structures play a major role

Motor	Gap between transformation and expectations, between desired reality and anticipated future.	Self-reinforced (through interdependencies, repetition, learning effects…)

Table 1: differences between resistance to change and organizational inertia

3 Spatial approach to organizational inertia: location and mechanisms

This preliminary review shows a need for conceptual tools to analyze *where* inertia is located, *how* it is reproduced and thus to identify more accurately adequate organizational responses. These questions become all the more important as emerging technologies tend to produce effects beyond the place of use and at multiple levels (e.g., Straub *et al.*, 2021; Vial, 2019; Winter et al., 2014). In the following section, we introduce two key concepts for a spatial approach to inertia, namely its *location* (the "where") and *inertial mechanisms* (the "how"). These concepts rest on a typology-based style of theorizing in which different dimensions of inertia and its underlying mechanisms are identified then "logically and causally combined into a coherent and explanatory set of types" (Cornelissen, 2017:3). This spatial approach builds upon the relative approach to deep structure and on multidimensional approaches to inertia. However, it was designed as theoretically neutral with regard to evolutionist, punctuated equilibrium or institutionalist perspectives in order to remain as integrative as possible.

3.1 Characterizing inertia by level of analysis

A first step to locate inertia lies in precisely identifying the level of analysis under scrutiny. Though it is defined as "organizational" in reference to what is rigid, inertia can come from a variety of levels (Baum and Singh, 1994). However, research streams developed isolated views and different vocabularies (Schmid *et al.*, 2017), ultimately resulting in a more difficult cumulation of our findings. Hannan and Freeman (1977) were already distinguishing five levels ranging from members of an organization to communities of organization populations. However, while their work provided convincing arguments to defend their population ecology perspective, we aim to develop a vocabulary that is better suited to act as a shared platform for the great variety of IS perspectives. We thus identify four levels of analysis that can encompass all research on organizational inertia. We label them the *micro* (individuals, routines and tasks), *meso* (groups, projects and organizations' subunits), *macro* (organization) and *meta* (ecosystems, environment, population of organizations) levels.

The most granular of these levels of analysis regroups research on the most fine-grained units of analysis such as individuals, routines and tasks. While among individuals, the users of a system are the most commonly studied (e.g., Kim and Kankanhalli, 2009), some would argue that emerging technologies challenge the relevance of the user as a concept (Rosenbaum *et al.*, 2003; Day, 2011). Equally relevant individuals could thus be members of an organization or freelance gig workers (Doshi and Tikyani, 2020). This *micro* level also encompasses tasks, processes or routines. These analysis at the micro level are particularly useful to identify and understand the roots of inertia at its smallest level, albeit they are less appropriate to uncover the complexity of collective phenomena. The *macro* level (e.g., Sarker and Lee, 1999; Mikalef *et al.*, 2021) is for its part centered on the organization and its capacity to adapt to its environment (Schmid *et al.*, 2017). The strength of this type of research lies in its capacity to view the organization as a whole that is not independent from its subparts or from its environment. A corollary risk yet lies in considering the organization as a *consistent* whole without accounting for the complexity of relationships between an organization's subparts. The *meso* level contains any intermediary unit between micro and macro levels such as departments (Haffke *et al.*, 2017), groups (Gersick, 1988) or projects (Desai and Chulkov, 2009). These analyses are particularly useful to uncover the collective dynamics that are often ignored at the micro level and simplified at the macro level. While Schmid (2019) proposed to define the meso level as focusing on multi-level analyses, we believe this would tend to equate levels of analysis and relationships between these levels. Lastly, the *meta* level regroups units of analysis at a scale larger than the organization. Although this meta level is not always accounted for

(Schmid *et al.*, 2017), it should play an important role in our theories of ISOT as the IS community is increasingly concerned with the role and effects of IT at the industry, digital value networks (Basole and Rouse, 2008) institutional infrastructure (Hinings *et al.*, 2018) or society levels (Majchrzak *et al.*, 2016).

3.2 Characterizing inertia by units of analysis

To precisely locate where exactly inertia is located or comes from, identifying the level of analysis yet remains insufficient. A second step lies in properly identifying the unit of analysis under scrutiny, independently from the level of analysis. On the one hand, very different units of analysis can be studied at the same level. At the micro level of individuals, the psychological inertia among users of a system (Polites and Karahanna, 2012) differs from psychological inertia within members of a top management team (Jarvenpaa and Ives, 1996). Similarly, inertia at the meta level can differ depending on the precise unit of analysis it comes from, such as public institutions, digital value networks or a community of organizations (Yang *et al.*, 2015; Kreuzer *et al.*, 2014; Lavie and Rosenkopf, 2006). On the other hand, the same unit of analysis can be studied at different levels. Inertia among IT developers can for instance be analyzed at the level of individuals, groups (Lyytinen and Rose, 2003), organizations (Fitzgerald, 1998) or in relationships with a partner organization (Palm *et al.*, 2010). Similarly, algorithmic decision-making can fuel inertia at the individual, group, organizational or society levels.

Identifying the relevant unit(s) of analysis is thus critical to analyze an organization's inertia. The key idea is that inertia is not evenly distributed across and beyond an organization, and that it may take one group of users, a single department or a specific relationship with a platform to paralyze a transformation initiative. However trivial this observation may sound, it is critical to bear it in mind when studying ISOT for at least a few reasons. Firstly, the revelant deep structure is relative to the unit of analysis under scrutiny. The deep structure of a group or department as a subpart of a larger whole is not the same as that of the whole, and analyses of inertia in different units of analysis should thus account for what is a core structure of this particular unit. Secondly, since different units of analysis can display different inertia, the relevance of organizational responses differs depending on the unit under scrutiny. Thirdly, clearly identifying the unit of analysis is necessary to avoid overly ambitious generalizations from one unit of analysis to the whole organization. Furthermore, management decisions that can help to overcome inertia in one unit of analysis may very well increase it in others. For instance, although appointing a Chief Digital Officer can help reduce socio-cognitive gaps with business actors, it may conversely increase the gap with the traditional IS function's mindset (Jöhnk *et al.*, 2019). Lastly, another reason to account for units of analysis is that emerging technologies tend to challenge the centrality of those that are the most commonly studied in our field (users, the IS function or the organization). Consequently, a great variety of units of analysis, often beyond an organization's boundaries, can contribute to its inertia. Research has for instance suggested that an organization's inertia can come from service providers (Richet *et al.*, 2016), customers (Verganti and Buganza, 2005), digital intermediaries (Cenamor *et al.*, 2019) or technologies such as AI, big data analytics or blockchain (Gligor *et al.*, 2021). While the organization most often is the unit of analysis that is described as locked on its current trajectory, its inertia can stem from ties to rigid elements of its environment.

3.3 Location of inertia

Levels and units of analysis help better locate an organization's inertia, but remain insufficient since they cannot account for cases where inertia is located between units of analysis or levels. Such cases have for instance been reported under the form of turf battles between departments or IT teams (Müller *et al.*, 2017; Jackson and Harris, 2003), socio-cognitive gaps between functional directions or branches (Hughes *et al.*, 2001) or between a "traditional" IS function and a digital team (Haffke *et al.*, 2016; Tumbas *et al.*, 2018; Jöhnk *et al.*, 2019). We thus introduce a third dimension in our spatial approach by distinguishing what we label its *location*. This location designates where inertia lies with regards to units of analysis. For instance, inertia located in the relationships between two functional departments can paralyze a transformation initiative just like inertia within a group of technology designers. We

identify three types of location: within a unit of analysis, between two units of analysis at the same level and between two units at different levels of analysis.

Firstly, inertia can be located within a unit of analysis. Political conflicts can for instance be rooted in diverging interests within a department or a group, such as the top management team or an IT project team. Psychological inertia can be limited to one profile of individuals, and compatibility issues can concern one particular functional unit. In most cases, this well-bounded type of inertia is easy to locate. However, in numerous cases inertia is located between two units that belong to the same level of analysis, for instance when two departments strongly disagree over the course the transformation should follow (Rumelt, 1995), when an e-commerce sales unit risks cannibalizing the historical channel (Jackson and Harris, 2003) or when two partner organizations adopt opportunistic behaviors that impede the transformation (Clemons *et al.*, 1993). In such case, not accounting for this relational location to focus on either unit could lead to concealing causes and effects in the other. Lastly, inertia can also be located between two units of analysis that belong to different levels of analysis. Ties to the environment (Dobrev *et al.*, 2003), to a general technology such as blockchain or AI (Gligor *et al.*, 2012) or to other organizations (Rosenkopf and Tushman, 1998) and platforms (Cenamor *et al.*, 2019) can for instance influence the inertia of an organization. This third type of location is of particular importance to understand broader transformation dynamics. In particular, it can help to explain how inertia moves from one level to another, and for instance how individuals, a specific group, a value network or the environment contribute to an organization's inertia.

One of the first benefits of such a spatial approach is that it helps to locate inertia more precisely than by relying on the organizational *core vs periphery* dichotomy. It allows to think of core and peripheral structures relatively to the unit under scrutiny as opposed to the organization. More pragmatically, by analyzing where exactly inertia is located, researchers and practitioners can develop a clearer understanding of what exact phenomenon impedes the transformation and hence craft better-targeted responses. Precisely identifying the location of inertia also reveals how organizational inertia manifests under different forms depending on its location. For instance, integrating an outsourced customer review system on an e-shop allows to avoid the economic inertia of in-house development and future socio-technical inertia due to the dependency on this legacy system. It may yet conversely establish a dependency on the provider's design choices, development roadmap, and ownership of customer reviews. Lastly, by identifying when inertia lies at the interface between different levels of analysis, this approach can offer a platform to discuss the causal trajectory (Markus and Rowe, 2018) of inertia, that is, its movement from a level of analysis to another. This last type of location can thus help us to build broader causal theories of information systems-related transformation. We represent the three dimensions of this spatial approach on the figure below (figure 1) with examples of units of analysis at different levels and examples of inertia at different locations.

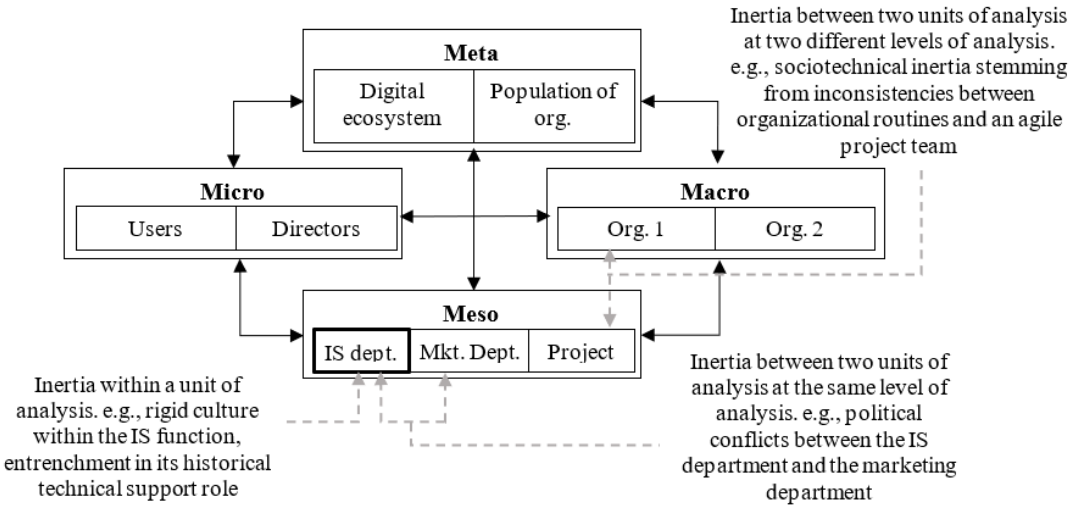


Figure 1: graphical representation of the location of inertia

3.4 Inertial mechanisms

Locating organizational inertia more precisely yet does not inform us on what mechanisms fuel and reproduce it. The identification of these mechanisms remains important if one is to discuss means to overcome inertia or its causal trajectory, in particular because similar forms of inertia can be reproduced by opposed mechanisms. As a consequence, the relevant organizational response differs when for instance sociotechnical inertia is fueled by a lack of system integration, incompatibilities or a too homogeneous IS. Similarly, the socio-cognitive inertia that stems from a strong cultural homogeneity or from the confrontation of incompatible values call for different responses. We thus identify four types of inertial mechanisms, which we label *parallel heterogeneity*, *conflictual heterogeneity*, *homogeneity* and *dependency*.

We use "mechanism" in the critical realist sense (Bhaskar, 2014; Smith, 2010) and define an inertial mechanism as a combination of social and/or technical structures that *can* generate or reproduce inertia, provided this mechanism is activated and its effects are not offset by another mechanism. However, precise inertial mechanisms are highly dependent on the case under scrutiny and their effects highly contingent on the presence of other mechanisms. We thus rather identify generic *types* of inertial mechanisms that are meant to represent inertial mechanisms' structure and provide a conceptual grammar to distinguish and classify them accordingly.

We define the first type of inertial mechanism, parallel heterogeneity, as the disjointed evolution of two elements that fail to converge, hence preventing a change in the organization's transformation trajectory. As an example, the socio-cognitive frames of an IT and of a business team may evolve in a parallel fashion, without converging or dialoguing with the other (e.g., Hughes *et al.*, 2001; Jackson and Harris, 2003). In the case of political inertia, a preference for the status quo can lead to conflict avoidance where two entities pursue their respective objectives with little to no coordination (e.g., Jarvenpaa and Ives, 1996). In the case of socio-technical inertia, the disjointed evolution of social and technical realms (Schmid, 2019) may lead to a lack of integration (Zhu *et al.*, 2006), a gap between technologies and skills that are needed to operate them (Jöhnk *et al.*, 2019), a limited convergence between processes and technologies (Barua *et al.*, 2004) or between physical and digital routines (Hoßbach *et al.*, 2016).

This parallel heterogeneity nonetheless differs from *conflictual heterogeneity*. This heterogeneity also rests on a divergence between two elements, but in this case this heterogeneity leads to clashes, confrontations and conflicts that paralyze the transformation. Instead of conflict avoidance strategies and preference for the status quo, political inertia then comes from turf battles or from the confrontation of diverging interests (Jöhnk *et al.*, 2019; Hughes *et al.*, 2001). Similarly, the confrontation of different values or analytical frames can generate socio-cognitive inertia (e.g., Hoßbach *et al.*, 2016). Conflictual perceptions of the transformation (e.g., as a threat or an opportunity) can also generate psychological inertia (Gilbert, 2005), while incompatibilities between technologies, processes and skills can for their part generate socio-technical inertia.

A strong homogeneity can also generate inertia for three reasons. First, homogeneity involves a relative absence of variety, and thus of alternative options to pick from. Second, this absence of variety often means that systems are less tolerant of new variety, be it cultural, technological or political. Lastly, this lack of alternatives further cements the self-reinforcing character of a deep structure through reproduction and learning. Cultural uniformity can for instance lead to groupthink effects (Janis, 1972), and create socio-cognitive inertia by blinding decision-makers to existing alternative options.

The last type of inertial mechanism we identify, dependency, is rooted in problems of interdependency and internal consistency. In this type of mechanism, the inertia of a structure comes from its coupling with another rigid structure that displays inertia. Dependency has long been identified as a cause for socio-technical inertia (Hannan and Freeman, 1984) but other forms of inertia have rarely been analyzed in this perspective. One could expect that a psychological attitude (e.g., anxiety when facing technology) could depend on another (e.g., the perception of the transformation as a threat). Interdependencies and relationships between different socio-cognitive frames received scant attention although research hints

at links between the fundamental goals of an organization, customer segmentation and approach to markets (Audzeyeva and Hudson, 2016). A comparable dependency between the internal and external identities of an organization has also been shown to generate inertia (Tripsas, 2009). In terms of economic inertia, the over-reliance on an external service provider (e.g., platform, customer review service, AI provider…) can lock an organization in its current business model. Lastly, political dependencies, whether reciprocal or unilateral, play a key role in power dynamics (Emerson, 1962; Standifer and Wall, 2010).

Examples of these four types of inertial mechanisms are represented in the table below for each form of inertia. On the graphical representations, the intended transformation trajectory is represented by a grey dotted line. The types of inertial mechanisms that are generating inertia and preventing from aligning the organization with the desired transformation trajectory are represented in black lines. These different types of mechanisms can be present independently of levels and units of analysis.

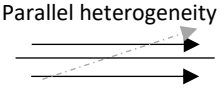
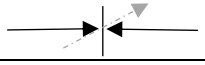
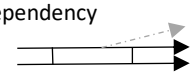
Form of inertia	Type of inertial mechanism			
	Parallel heterogeneity 	Conflictual heterogeneity 	Homogeneity 	Dependency 
Psy	Parallel psychological attitudes (e.g., enthusiasm and anxiety toward technology)	Conflict between incompatible perceptions of the transformation	Uniform attitudes (e.g., fear, anxiety, enthusiasm)	Attitude that depends on another (e.g., fear of the transformation and perception of a threat)
SC	Disjointed evolution of socio-cognitive frames, entrenchment in two different socio-cognitive frames	Conflict between cultures, values, or incompatibilities between analytical frames	Cultural uniformity, groupthinking, domination of a socio-cognitive frame	Dependency of a socio-cognitive element upon another (e.g., criteria to make a decision and an organization's values)
ST	Disjointed evolution of skills, routines and technologies	Incompatibility between technologies or between technologies and skills or routines	IS too homogeneous to allow unplanned cases, lack of variety in skills	Too strong IS integration, dependency on an infrastructure, technology and skills dependency
Eco	Existence of parallel business models that prevent transformation toward a new one	Cannibalization, conflicts between exploitation and exploration, resource-allocation conflicts	Dependency on a single resource or business model	Economies of scale, cross subsidies, economic dependency of a sales channel on another
Po	Conflict avoidance, preference for the status quo	Conflicts and political turf battles	Political domination by an entity	Mutual or unilateral political dependency

Table 2: types of inertial mechanisms and examples of inertial mechanisms

4 Discussion

With this spatial approach to inertia, we seek to develop a new more space-oriented mindset in the analysis of inertia and ISOTs. We believe it can help to more accurately understand and describe where inertia is located and how it is reproduced, in particular at a time where emerging digital technologies and their effects span across levels of analysis. For this spatial approach to accommodate various streams of research, we tried not to overly define specific units of analysis, locations and mechanisms. Instead, we chose to focus on generic definitions to provide flexible concepts for further developments. In the following sections, we discuss the contribution to this approach to research on ISOT and outline five theoretical propositions before discussing its limits and future research avenues.

4.1 Contributions of these spatial concepts

We believe these spatial concepts have three main strengths. First, the concept of location offers a first level of contribution to the literature on ISOT by allowing for more analytical precision in formally identifying where transformation difficulties stem from. Specifying the relevant levels and units of

analysis along with the location of inertia is a means for practitioners and researchers alike to better identify *where* inertia precisely lies and thus to craft better-targeted organizational responses upon which the outcomes of the transformation initiative ultimately depend. Just like managerial action should match in strength the inertia that maintains the organization on its current track in order to overcome it (Besson and Rowe, 2012), we argue that the efficacy of this managerial action depends on the fit between its target and the location of inertia. We thus propose:

P1a: the location of inertia influences the ISOT trajectory and its outcomes.

P1b: the efficacy of managerial action in overcoming inertia and transforming the organization depends on the fit between the target of this managerial action and the location of inertia.

For research, the concept of location also helps to more precisely delimit possible generalization of findings to other locations or to the whole organization and to acknowledge which units were examined or which were not. In this regard, analyzing the location of inertia also allows to better communicate our findings with regards to the rest of the literature and its various streams. This contextualization of our findings furthermore helps better delineating their possible limits, partly because what is observed at one level is not necessarily true at another and partly because thinking in terms of location raises awareness on possible opposite effects in different parts of an organization.

Second, the concept of inertial mechanism and the four types we identify can help to analyze the causal complexity at play in ISOTs, which may be blurred in varied levels and numerous internal and external actors. Uncovering the type of mechanism at play is helpful in the analysis of ISOT since they frame what inertia can manifest. Although they are illustrative and not exhaustive, the examples provided in table 2 for each nature of inertia can help researchers to identify and understand what type of mechanism reproduces the inertia they analyze, or to guide their investigations on the presence or absence of inertia. In addition, identifying the inertial mechanisms at play generates insight on what organizational response may or may not effectively deactivate or compensate them. This leads us to formulate the following propositions:

P2a: the type of inertial mechanism at play influences organizational inertia.

P2b: the efficacy of managerial action in overcoming inertia and transforming the organization depends on the fit between this action and the inertial mechanisms that fuel inertia.

Furthermore, different mechanisms can play in opposite directions and obfuscate their effect. These effects can be difficult to analyze if conflated at the organizational or industry level. The activation of different inertial mechanisms has for instance been proposed as a way to bridge perspectives according to which the perception of a threat triggers or inhibits ISOTs (Gilbert, 2005), or to explain why different governance choices lead to different inertias (Tumbas *et al.*, 2018). These insights into inertia generation processes are also relevant to transformation management for they can highlight inertial trade-offs, that is, cases where two alternative transformation decisions would face different inertias in different locations or through different mechanisms. For instance, opting for cross-functional project-based management of the transformation can limit parallel heterogeneity by reducing cultural gaps between business and IT teams. However, it can conversely generate resource allocation conflicts between projects (Haffke *et al.*, 2017; Tumbas *et al.*, 2018). Building agile teams that are more independent from the rest of the organization reduces their dependency on existing routines, cultures and political coalition, but can increase socio-cognitive gaps and system integration difficulties (Haffke *et al.*, 2017; Tumbas *et al.*, 2018). Accounting for the inertial mechanisms managerial actions can inadvertedly activate instead of solely focusing on their deactivation or offset opens the way for a more comprehensive understanding of why transformation can derail. By revealing possible inertial trade-offs or effects affecting different parts of an organization, a researcher can draw hypotheses on the possible risks and limits of transformation strategies. We thus propose:

P2c: Managerial action can activate inertial mechanisms and thus fuel inertia in the same or in a different location.

We represent these propositions in a spatial model of fit between inertia and managerial actions whereby the ISOT trajectory depends on inertia, on managerial actions, and on the fit between the two. Beyond the classical fit between the strength and nature of inertia and managerial action, this model also incorporates the idea that managerial action should target inertia where it is located, should consider what type of inertial mechanism is at play, and what other mechanism it could activate.

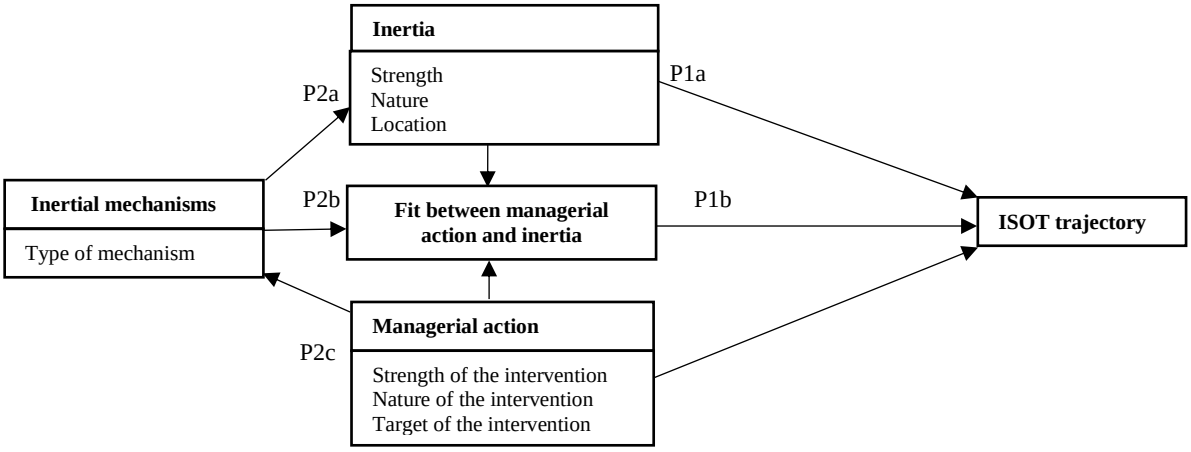


Figure 2: a spatial model of fit between managerial action and inertia

A last contribution of these two concepts lies in their ability to support theorizing on the causal trajectory (Markus and Rowe, 2018) of ISOT. Precisely locating inertia is helpful to uncover relationships between different levels of analysis and thus how inertia can spread or be successively overcome across an organization and its environment. This point is particularly relevant to understand the effect of emerging technologies that span across levels of analysis, involve the outsourcing of new key technological processes, or rely on new types of resources such as crowdwork and massive external data sets.

4.2 Limits and avenues for future research

This spatial approach yet remains incomplete. We identify two current limits and corresponding avenues to advance it. First, this spatial approach could be integrated with temporal or processual approaches to ISOT. Second, interactions between different forms of inertia also contribute to difficulties in analyzing inertia. We offer preliminary insight on how these could be analyzed and reveal specific inertial mechanisms.

By proposing this spatial approach to ISOTs, we do not mean to underplay the importance of their temporal or processual dimension. On the contrary, we tried to adopt an approach that would be compatible with various perspectives (continuous or episodic, more or less radical change, etc.) so it can complement a processual analysis. Like the strength of inertia varies across phases of the transformation (Besson and Rowe, 2012), its location and underlying mechanisms can change as well. We envision two main ways to extend this spatial approach with a processual lens. Firstly, one could trace the diffusion and erosion of inertia across levels and units of analysis along the transformation process. Political conflicts for instance vary through the course of a transformation (e.g., Smolander and Rossi, 2008) and one could analyze their evolution under both a spatial and temporal lens. Similarly, the spread and confrontation of socio-cognitive frames between departments or cascades of successive technological integration issues could be studied with both a space and process perspective. Spatial and processual approaches can also be combined to examine how inertial mechanisms change across time. Such a combination would for instance allow to analyze how a mismatch between an AI algorithm and human analysis can gradually shift to over-reliance and trust in the system, or how conflicts over data ownership between the IS function and a service provider can turn into a dependency relationship.

Another avenue lies in identifying possible interactions between different forms of inertia, which could reveal new or understudied specific inertial mechanisms. For instance, how should inertia be analyzed

when the political conflicts that paralyze the organization perfectly match the socio-cognitive divides between two departments? Do high sunk costs and risks that paralyze decision-making amount to psychological or economic inertia? Similarly, the boundary between socio-cognitive and socio-technical inertia is not always clear, both being reinforced through learning effects and the repetition of routines (Schmid, 2019). This question is important if one hypothesizes that two interwoven inertias can be stronger than their sum (e.g., Koch *et al.*, 2020) and can reinforce each other. In Table 3 below, we identify examples of possible interactions between the five forms of inertia as distinguished in Besson and Rowe (2012).

Inertia	**Psychological**	**Socio-cognitive**	**Socio-technical**	**Economic**
Socio-cognitive	Integration and removal of psychological attitudes in socio-cognitive frames (e.g., attitude towards risk, towards failure…)			
Socio-technical	Technology features that influence psychological inertia; influence of psychological attitudes on skill development.	Routines as shared source of socio-cognitive and socio-technical inertia; lack of congruence between socio-cognitive frames and routines; technology as a translation tool between different socio-cognitive frames; automation of cognitive tasks through AI.		
Economic	Perception of risks by decision-makers, psychological approach to economic decisions.	Conflicts between values and digital business models (e.g., digital press, data brokering, data extraction, social scoring)	Economics of standards; trade-offs between socio-technical and economic consequences of outsourcing decisions	
Political	Psychological roots of political resistance; trade-offs between personal, corporate and user/customer risks	Structuration of conflicts following cultural divides; influence of organizational culture on IS-related conflicts within the organization or with its environment	Political approaches to routines as a form of organizational truth or as a substrate for political conflicts; influence strategies for the control of digital infrastructures	Resource allocation-related conflicts; conflicts between exploration and exploitation activities

Table 3: examples of interactions between different forms of inertia

5 Conclusion

While there is a long tradition of processual analysis of ISOTs, the question of *where* inertia is located and *how* it is reproduced and spreads through levels of analysis has received too scant attention. From the great diversity of perspectives on organizational inertia, we draw a first sketch of a spatial approach to organizational inertia. It rests on the idea that precisely locating inertia within a unit of analysis, between two units at the same level or between two units of analysis at different levels matters for both researchers and practitioners to understand transformations and identify appropriate organizational responses to difficulties. We believe this spatial perspective is valuable to avoid conflating all inertia at the organizational level, to avoid obfuscating complex sets of inertial mechanisms that can play in different directions, and to hold a discourse on the causal trajectory of inertia across levels of analysis.

To respect the different streams of research that contributed to theories of organization inertia and to avoid needlessly excluding any of them, we tried to keep the types of locations and inertial mechanisms we identify as generic as possible. We hope this will encourage the development of more spatial perspectives regardless of researchers' theoretical stance on organizational inertia.

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