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RESEARCH PERSPECTIVES

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Research Perspectives: An Encompassing Framework for Conceptualizing Space in Information Systems: Philosophical Perspectives, Themes, and Concepts

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Abstract

The conceptualization of *space* is integral to many of the diverse forms of information systems—for example, the physical space represented in geographical information systems and the virtual space of simulated worlds. Yet despite its importance and centrality, the conceptualization of space in information systems is not as sophisticated or mature as in other fields. A lack of attention to the diversity of perspectives on space hampers ongoing research and the re-visioning of phenomena that could lead to new insights in information systems. The aim of this paper is to develop an encompassing framework that provides a comprehensive view of philosophical perspectives, spatial themes, and concepts of space that are relevant to information systems. As a result of an extensive literature review, an encompassing framework is presented that includes four prominent spatial themes: representing space, differentiating space, disclosing space, and intuitive space. Each theme is related to its key characteristics and features and underlying philosophical perspectives. The paper demonstrates how the new framework can facilitate IS scholars' expansive analysis in scholarly work and assist editors and reviewers in evaluating papers concerning space in IS and shows how the re-visioning of phenomena can lead to transformational shifts in understanding IS phenomena.

Keywords: Space, Information Systems, Philosophy, Conceptualization, Encompassing Framework

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1 Introduction

Space is a complex and polymorphic phenomenon that pervades our everyday activities and lives (Malpas, 2012a). Human beings live in and through various spaces on a day-to-day basis without necessarily thinking about what space is, what bearing it has on our ways of living, or how it enables various actions or happenings to take place (Casey, 1999). Space is seen as having the intrinsic features of transforming societies, organizations, and technology (Lefebvre, 1991). Space is also known for becoming transformed through technology's capacity to frame humans' existence, comportment, thinking, working, and understanding of reality (Heidegger, 1973; Malpas, 2000).

A conceptualization of space is integral to many of the diverse forms of information systems, such as in the physical space represented in geographical information systems and the virtual space in simulated worlds. The nature of the space known as the "dark web" has implications for anonymity, crime, and security measures (Abbasi & Chen, 2007; Chen et al, 2008). The emergence of empowering opinion makers and influencers in virtual spaces such as social media has profound political and social implications

(Susskind, 2018). Cloud computing conjures images of computing that are "nowhere" in space, yet the cloud relies on data centers and server farms that occupy specific physical spaces and have significant environmental impacts.

The treatment of space and the internet historically is one demonstration of the emerging engagement with space in the field of information systems (IS) in a serious way. For example, the internet was seen as "nowhere," as "cyberspace," as "disembodied" or as "a frontier," and the use of older spatial imagery of highways, webs, clouds, matrices, railroads, tidal waves, libraries, and village squares provides an odd mix of spatial concepts (Gozzi, 1994). Yet early descriptions of the Internet as boundary-less, as "placeless," or through the metaphor of "making everywhere here" (Cairncross, 2011), established a radical departure from Euclidian concepts of space. However, despite this centrality and historicity of space in our everyday encounters with modern IT (e.g., the internet), little attention has been paid in IS to strengthening and clarifying conceptualizations of space. Consequently, it is difficult to find coverage in IS research of the diversity in perspectives of space, both epistemologically and ontologically, in a comprehensive way to answer fundamental questions about space: *What are the conceptions of space? What does space mean? How is space materialized or manifested?* Similar issues have been addressed in other fields such as philosophy (e.g., Malpas, 2012a, 2012b, 2017), social geography (e.g., Arias, 2010), and management (e.g., Clegg & Kornberger, 2006), where the focus has been on conceptualizing space by explicating its pluralistic meanings, definitions, and ontological views. But to date, engaging with space in IS phenomena is an emerging subject for IS research. This situation has created a research opportunity to recognize a spatial perspective in IS and to address a set of key issues, which open up opportunities for new research and a deeper understanding of IS phenomena. The key issues are presented as follows.

First, a *lack of clarity* makes it difficult for researchers to comprehend or to use the whole spectrum of spatial concepts dealing with specific phenomena in a meaningful way (Dubin, 1976, 1978; Metcalfe, 2004). Within IS, views on space have been operationalized by researchers (e.g., Ciolfi & Bannon, 2005; Sahay, 1997; Sarkar & Sahay, 2004) with implicit emphasis placed on elucidating underlying ontologies that help to clarify space for IS scholars (Mitev & De Vaujany, 2013). In other disciplines such as philosophy and social geography, researchers have clarified space explicitly through metaphysical discussions regarding space and existentialism (Heidegger, 1973), the ontological relationship between place and space (Malpas, 2012a, 2017), space and the emergence of socio-geographical power relationships (Foucault & Miskowiec, 1986), and through clarifications that aim to understand the boundaries and interplay between space, place, and technology (e.g., Graham, 1998a, 1998b).

Second, the absence of underlying perspectives of ontology and epistemology in the conceptualization of a phenomenon generates *a lack of conceptual boundaries* for a polymorphic phenomenon such as space. Existing bodies of literature outside the IS field, in philosophy, social geography, and psychology, offer a variety of rich perspectives on space. However, what is currently open for elaboration is a parsimonious approach that guides a researcher across disciplines on how to conceptualize space for research in their own research field (Malpas, 2017). As such, the rich perspectives outside of IS offer concepts that treat space as both a reinforcer and enabler of digital innovation (Peschl & Fundneider, 2008, 2012), a facilitator of collaboration and learning via virtual worlds (Tokel & Isler, 2015), a producer and transformer of workplaces and organizational practices (Towers et al., 2006), and a consumer of spatial boundaries at workspaces (e.g., offices, open landscapes) through the diffusion of technologies (Kitchin & Dodge, 2014). But at the same time, the rich perspectives possess a complex structure of conceptual boundaries (Malpas, 2017), which makes it difficult for scholars from outside a particular field (e.g., a field where a specific concept originates), such as IS scholars, to deal with spatial concepts in an encompassing and comprehensive way.

Third, inadequacies in the conceptualization of a phenomenon that aims to explain its utility and significance for research, tend to *limit the application range* of a concept (Alavi & Carlson, 1992; Dubin, 1979; Weick, 1989). For instance, numerous writings that conceptualize space (e.g., Arias, 2010; Malpas, 2012a, 2012b, 2017) make the point that each field of study does, and should, interpret space in a distinctive manner, building on a cumulative tradition of prior works in order to address the field's unique subject matter or phenomenon of interest. For instance, in philosophy, numerous concepts of space have been conceptualized to inform foundational views around the nature of space and what it means for human reality (Harvey, 1978; Heidegger, 1973). These concepts have, in turn, been adopted and applied in other fields, such as social geography (Harvey, 1978; Arias, 2010) and management (Clegg & Kornberger, 2006). Hence, there is certainly an abundance, application, and cumulative tradition of conceptual literature on space in other fields, and in IS, we as scholars have now the opportunity to develop a greater awareness of the role

of space in IS phenomena by embracing such a body of knowledge to conceptualize space in IS.

Against this background, the aim of this paper is to develop an encompassing framework that provides a comprehensive view of spatial themes, concepts, and underlying philosophical viewpoints relevant to information systems. The development of our framework draws inspiration from similar studies that have aimed to conceptualize complex phenomena and strengthen concepts commonly used in IS. Examples are Orlikowski and Iacono's (2001) conceptualization of the IT artifact, McKinney Jr. and Yoos's (2010) conceptualization of information in IS research, and the conceptualization of time by researchers such as Ancona et al. (2001) and Kunisch et al. (2017). We addressed this aim by reviewing, analyzing, and synthesizing extant literature on space in fields such as philosophy, psychology, and social geography, where the discussion of space has advanced considerably over time.

Our new framework contributes to the IS field by providing scholars with a cohesive body of knowledge on space that can help them conceptualize space more fully. The framework targets IS scholars as authors, editors, and reviewers who have an emerging interest in or are directly involved with research on space in IS. While we acknowledge that the extant multidisciplinary literature on space from which we draw is relatively mature, we believe that this study, situated in IS, advances aspects of this wider body of knowledge and provides more contemporary thoughts on its application. We hope that this paper thus stimulates further reflection, debate, and ultimately execution of the spatial elements of IS research.

The remainder of the paper proceeds as follows. First, we present a background section that explicates philosophical perspectives on space. Second, we present our research approach as a literature review and analysis of cross-disciplinary literature on space. We then present the findings of the paper in the form of an encompassing framework consisting of underlying philosophical perspectives on space together with spatial themes, spatial concepts, and spatial characteristics. We show how the framework can facilitate expansive analysis in scholarly work and the re-visioning of phenomena that can lead to transformational shifts in understanding. Finally, we provide a concluding discussion and outline for further work.

2 Philosophical Perspectives on Space

Before conceptualizing space for IS, one must first consider the extant philosophical perspectives on space that underpin the ideas, definitions, meanings, and conceptions of space (Malpas, 2017). The philosophical perspectives on space provide foundational ideas on what space means, how space can be defined, perceptions of space, the manifestations of space, how space affects the social life of human beings, the implications of space for societies, and much more (Dainton, 2010; Friedman, 1983). Hence, for this paper, we need to explicate the philosophical perspectives on space that have been adopted, employed, expanded, and built upon across disciplines such as cognitive science, psychology, and neuroscience (e.g. Cheng et al., 2019); linguistics (e.g. Bowerman 1996); human-computer interaction[1] (e.g., Dourish, 2004, 2006; Dourish & Bell, 2007; Harrison & Dourish, 1996; Saker & Frith, 2019, 2020); management (e.g., Bradbury & Lichtenstein, 2000; Clegg & Kornberger, 2006); and social geography (e.g., Harvey, 2001, 2010; Massey, 1995, 2005, 2009, 2013; Valentine, 2014).

We identify important philosophical perspectives that are presented in Table 1 and operationalized further in this paper to: (1) acknowledge the complexity of space in light of prior cross-disciplinary research, (2) incorporate epistemological and ontological views on *space*, and (3) inform our literature review on space (this point is elaborated further in Section 3.1). The philosophical perspectives shown in Table 1 are based on initial ideas of space that stimulated the authors through prior readings and thinking about space—our preliminary understanding was then refined iteratively as we studied the utility of spatial concepts in IS through the empirical analysis that occurs later in this paper. Our overview of philosophical perspectives on space is presented here to aid readability.

Our list of philosophical perspectives on space is nonexhaustive and not mutually exclusive. Further, it is nearly impossible to do justice to each perspective within the confines of a journal article. Thus, the perspectives shown in Table 1 were chosen as indicative of the characteristics, definitions, conceptions, and meanings of space from different philosophical schools and ways of spatial thinking—for a more detailed coverage we refer the reader to sources such as *The People, Place, and Space Reader* by Gieseking et al. (2014). We now discuss the philosophical perspectives in turn.

[1] Human-computer interaction and geographic information systems/social geography can be seen as areas of knowledge within IS. In this essay, as they are distinctive and important areas, we have grouped them separately.

Table 1. Philosophical Perspectives on Space

Perspective	Description	Example sources
Formal perspective	Conceptualizes space through representing views of reality such as a container with physical boundaries and room for places or things. This perspective is evident in efforts to measure and map space features and boundaries of space.	Aristotle (350 BCE/1987) Reichenbach (2012)
Sociopolitical perspective	Conceptualizes space as a social construct, meaning that space is constructed (produced and reproduced) through activities that require an active form of participation and engagement among groups of individuals (e.g., labor, social processes).	Habermas (1962/1991) Lefebvre (1991)
Phenomenological Perspective	Conceptualizes space as an emerging phenomenon that facilitates meaningful happenings and allows other phenomena to emerge and take place.	Heidegger (1927/1962) Malpas (2017)
Intuitive Perspective	Conceptualizes space with regard to human intuition and suggests that humans in general are born with innate capabilities that predispose them to develop impressions of the world in certain ways, which in turn can lead to individuals' a priori cognitions about the world.	Janiak (2016) Kant (1999)

2.1 The Formal Perspective on Space

The *formal perspective* on space can be traced back as far as Aristotle's work on physics (350 BCE/1987)) and was elaborated by Hans Reichenbach (2012). Reichenbach (2012) viewed physical geometry as being about physical objects in physical space and argued formal systems of physics and geometry needed to be compared to empirical observation to select the most appropriate representation system. From this perspective, space is considered to be essentialist, that is to say, a kind of absolute space (e.g., container, grid), within which objects are located and events occur (Curry, 2008; Shields, 1997). In essence, the formal perspective conceptualizes space, as associated with physical entities, using material shapes and properties that embody the physical boundaries and representation of movement, interaction, and events in our everyday lives.

Examples are many and include the interaction of humans with objects (e.g., containers, boxes, glass, buckets), the terrain (e.g., maps), buildings (e.g., prisons, malls), offices (e.g., open landscape offices), and rooms (Hornecker & Buur, 2006). Further examples include the physical interior, with respect to the measurable boundaries and distances between objects; collaborative spaces that are dedicated to activities (e.g., knowledge sharing and management, collaboration) (Robinson & Sharp, 2010); and the organization of interaction in physical spaces (Leonardi et al., 2012). Humans use a variety of means to communicate about the properties of physical spaces, and work in linguistics has shown that the language used for space representation may be culturally dependent (Levinson 1996). For example, some languages do not have words corresponding to left and right distinctions in English. Based on this perspective, we understand and define space as: *a physical container that is represented in some form (e.g., words, maps, drawings) to indicate its geometrical arrangements, whose representation might in turn structure, constrain, and enable certain forms of movement, interaction, and events*.

2.2 The Sociopolitical Perspective on Space

The *sociopolitical perspective* on space is evident in Karl Marx's early ideas on space (see Garnier, 1993 for a detailed overview) and was later elaborated by the Marxist thinker and theorist of space, Henri Lefebvre (1991). In contrast to the formal perspective, the sociopolitical perspective argues that space is a social construct that is constructed by human beings through human labor, processes, and social practices (Stanek, 2011) and is produced and reproduced over time (Lefebvre, 1991; Merrifield, 1993). From this perspective, space is no longer understood as essentialist, but more relational in terms of having more metaphorical qualities that appear far removed from absolute conceptions of space as a container or grid (Hubbard et al., 2002; Unwin, 2000). Early ideas regarding the sociopolitical perspective can also be found in Habermas's (1962/1991) concept of "the public sphere," which Habermas defines as a virtual or imaginary community that does not necessarily exist in any identifiable space. According to Habermas (1962/1991, p. 27), public spheres are conceived as the sphere of private people coming together as a public to engage themselves in debate about societal problems that are discussed to influence political action. In essence, the sociopolitical perspective conceptualizes space as a socially constructed phenomenon that is produced and reproduced through human interaction and social processes (e.g., practices, labor, happenings, and events).

Examples of the public sphere include social spaces that emerge in physical places, such as cafeterias, libraries, pubs, and city squares; social spaces that occur through action (e.g., demonstrations, political rallies); and social spaces that are technologically mediated to facilitate

public debates via internet channels such as online discussion forums and social media groups (Bruns & Highfield, 2015; Fuchs, 2014; Lunat 2008). Other examples of the sociopolitical perspective include the transformation of sociopolitical landscapes due to the digitalization of institutions (Majchrzak et al., 2016) and the ongoing digitalization of politics in general (Susskind, 2018). Based on this perspective, we understand and define space as: *a social construct that is formed, produced, and reproduced over time through human conduct, such as social processes, practices, interactions, ideologies, and through factions that are technologically enabled and supported.*

2.3 The Phenomenological Perspective on Space

The *phenomenological perspective* on space is evident in Martin Heidegger's (1927/1962) ideas on spatial phenomena, clearing, places, sites, and dwelling, which are rooted in a phenomenological ontology that understands reality from the firsthand experiences of phenomena (Van Manen, 2016; Zahavi, 2018). In contrast to the formal perspective and sociopolitical perspective, the phenomenological perspective on space conceptualizes space as an enabler of phenomena (also known as "spacing," see Heidegger, 1927/1962) rather than a constraint: boundaries are not where something stops but where something begins its presenting (e.g., space enables an action rather than constraining it) (Malpas, 2012b). The phenomenological perspective on space challenges the sociopolitical perspective by critiquing the idea that space can be reduced to a social construct, which ignores questions about the character of space independently of its socially constructed or imagined character (Malpas, 2017). That is, space underpins the very possibility of construction itself and cannot thus be a subject reduced to social constructivism alone because that would contradict the fact that all kinds of constructions and creations take place in space. In essence, the phenomenological perspective conceptualizes space as an enabler of phenomena to occur and take place and focuses on the individual's mode of feeling, sensing, prioritizing, and spatial living and orientation as fundamental prerequisites for even perceiving space (Malpas, 2012b, 2017; Schatzki, 2017; Wollan, 2003).

Examples include the feeling of *being distant* or *being close* in social media contexts (Hoffman & Novak, 2013), which becomes transmitted as only a feeling or a sensation without any further consideration to objective measures of the distance between two spatial locations (e.g., the distance between two cities). Other examples include the impact of relationship characteristics and online social network features on loneliness (Matook et al., 2015), perceived spatial proximity in virtual work (Wilson et al., 2008), and ordinary feelings of remoteness or closeness as attached to the sensation of being close to someone or something—e.g., the statement that "there is a space between us" or "I need my own space." Based on this perspective, we understand and define space as: *an experienced field that is expansive and enables phenomena (e.g., activities, happenings, emotions, perceptions) to emerge and take place through firsthand experiences.*

2.4 The Intuitive Perspective on Space

The *intuitive perspective* on space is evident in the work of Immanuel Kant (1781/1999), who argued that our experience of the world is predicated on the nature of the human physiological system. The physiological system provides structuring of its representations (intuitions) prior to mental representations (concepts) (Janiak 2016): "… there are objects that exist in space and time outside of me, which cannot be proven by a priori or a posteriori method" (B 274, qtd. in Janiak 2016). In contrast to the previous three perspectives, the intuitive perspective on space sees space as a phenomenon as sensed through our intuition rather than a physical manifestation (the noumena in Kant's terms). In essence, the intuitive perspective conceptualizes space as a phenomenon as sensed through intuition, where the feeling of depth, width, sphere, roundness, blurriness, fluidity, and other kinds of subtle, nontangible experiences characterize how we encounter space.

Examples of studies that illustrate this perspective can be found in experimental psychology work that shows that infants learn a great deal about space before they learn to talk (Bowerman 1996). Numerous studies utilizing the "visual cliffs" apparatus have shown that humans, as well as members of other species, seem to be able to perceive and avoid sudden increases in depth as soon they can move about and before language has developed (Gibson & Walk 1960). Spatial senses include vision, audition, olfaction, gustation, and touch (Cheng et al. 2019). In addition, proprioception refers to the sense through which the position, movement, and location of the body and its parts are perceived (Jones et al., 2012). The visual sense is recognized as particularly important in forming intuitions of space, and the human visual system is considered in work on representing perspective in art, developed largely in the Renaissance (Kubovy, 1988). The theory of perspective is key in computer graphics, where efforts are made to develop "visual tricks" to simulate three-dimensional depth in the two-dimensional plane of a computer screen or other device (Peddie 2013). These techniques from computer graphics are then utilized in areas such as e-commerce, virtual reality (VR), and augmented reality (AR). In summary, the intuitive perspective conceptualizes space as an outcome of our intuitions of certain aspects of the physical world as

made available through human senses. Based on this perspective, we understand and define space as*: intuitions of spatial aspects of the world, such as length, height, depth, distance, and volume, made available to humans through their senses.*

2.5 The Relation between Space and Place

The philosophical perspectives on space have led to discussions about the relations between space and other similar constructs, such as place, region, area, and zone (e.g., Malpas, 2012a, 2012b, 2017), which have become critical in increasing awareness among researchers seeking to conceptualize and elaborate space (Arias, 2010). In particular, we find it important to outline a brief discussion on the relation between space and place.

An avenue to explicate the definitions, and conceptions of a complex phenomenon is through understanding it in relation to other phenomena that are, by nature, interrelated (see, for instance, similar work such as the explication of "presence" by Lee, 2004). In the case of space, there are several interrelated phenomena that are associated with space and have influences and impacts that are often more a matter of rhetorical positioning than conceptual substance (Malpas, 2017). Examples of such terms are *topography*, *zone*, *region*, *area*, and *place*, where the latter (place) is the term that, according to Malpas (2017), is most frequently associated with space across disciplines, both on a conceptual and practical level. Researchers (e.g., Arias, 2010; Casey, 1999; Aristotle (350 BCE/1987); Malpas, 2012a, 2012b, 2017) have stressed the importance of conceptualizing the relation between space and place in order to understand their conceptual and practical boundaries for cross-disciplinary research. Their reasoning is that both space and place are broad terms with a wide range of definitions and meanings, which stretch across obvious physical locations, through more intuitive, social, and virtual locations, with different and similar features. Defining both separately and in relation to each other can, however, be a complex, challenging, and important task (Malpas, 2017).

When we discuss place in relation to space in this paper, we are seeking only to understand the conceptual relation between place and space in order to understand the significance of space. Our understanding undertakes a reflective mindset rather than an uncritical one, because otherwise one risks treating space and place as synonymous concepts, as explained by Malpas (2017, p. 3) in the following passage: "… in discussions of space and place, one often finds an uncritical appropriation of these concepts that actually assimilates the one to the other, or that, if it does distinguish them, does so in a way that is so weak as to not be capable of being any significant conceptual weight."

In summary, place in this paper is viewed as: "the dynamic opening that occurs within bounds. As such it does not operate as a determinate principle, but rather as making possible the determination of that which appears within and in relation to it." (Malpas, 2017, p. 11-12). We thus understand from this view, that in relation to space, place is viewed as the matrix within and out of which the social itself (e.g., social interaction, social identities, social status) is formed, while space enables and provides its polymorphic medium (e.g., shape, boundaries, container, void). In contrast to place, space is then characterized and defined through features such as openness, expansiveness, and room that warp or stretch the space around and within a place Malpas (2017, p. 3).

3 Literature Review Approach

This paper employed a literature review to identify prior conceptual work that assists in elucidating the complexity and nuanced polymorphous characteristics of space. More specifically, we adapted the process of Paré et al. (2016) to our context and combined it with the philosophical perspectives (outlined in Section 2) to inform both the review process and the review plan. This process allowed us to identify spatial concepts, the underlying assumptions of what space means and the diverse and distinct ontologies of space, and revealed the conceptual characteristics of space across the identified literature. As such, we classify our review approach as a broad one closely related to a theoretical review, which incorporates sources of literature that are based on both empirical and conceptual knowledge for developing a conceptual framework or model that is based on a thematic analysis (Paré et al., 2016). We now discuss the overarching steps of this review more extensively to enable repeatability and transparency.

3.1 Review Plan

The central goal of our review was to synthesize existing ideas on space with new ones that emerged from reviewing a rich corpus of cross-disciplinary literature on space. This goal was addressed by: (1) searching and identifying cross-disciplinary literature that provides conceptual knowledge on space and (2) synthesizing the identified literature to present a body of rich, yet dispersed, knowledge of space. In addition, we employed philosophical perspectives to inform the review plan, which provided us with an early foundational understanding of space as a phenomenon, rather than starting with a blank slate. More specifically, the philosophical perspectives contributed to the review plan by: (1) informing ontological understandings of space that provide different conceptions, definitions, and meanings of the nature of space (e.g., what conceptions and manifestations of space exist), and (2) informing conceptual characteristics and boundaries of space (e.g., the difference between space and place, characteristics of space concepts) rooted in different

philosophies. The philosophical perspectives helped us initially to formulate key terms and phrases for the literature search process by informing relationships between identified spatial concepts with philosophical perspectives (e.g., binding the concept of *body space* with the intuitive perspective) and reconfiguring the perspectives through the identification of spatial concepts (e.g., elaborating the characteristics of each perspective through features of a spatial concept).

3.2 Literature Identification

To gather and select the set of papers for the review, we followed the steps for inclusion and exclusion as highlighted in Figure 2 below. While our review aims to conceptualize space for IS research, being a multidisciplinary endeavor, our boundary identification is not confined to the IS discipline alone. Instead, we searched and incorporated literature from multiple disciplines including philosophy, management, organizational science, human-computer interaction, geographical information systems, psychology, computer science, educational sciences, physics, information and media, sociology, and social geography. We focused not only on disciplines where the term space is used, which includes almost every discipline imaginable, but rather on disciplines where space has been studied, theorized, and expanded extensively over time to a degree of sophistication and reflection that goes well beyond what has been done in IS.

Because our literature review focused on papers where space has been a central phenomenon of inquiry (empirically and conceptually), our search terms aimed to identify a corpus that deals explicitly with space. Therefore, we applied several search strings, with "space" as the central term, followed by default fields such as "AB" (Abstract) or "ID" (Key Concepts) or "TI" (Title) or "SW" (Subject Headings), as well as the logical operators "OR" and "AND" (e.g., space AND organizations OR management AND concept, space OR spatial AND human-computer interaction AND design), to target the conceptual and empirical elements of space. We queried a set of search engines and databases (e.g., EBSCO Academic Source Premier, ScienceDirect), resulting in a long list of over 1799 retrieved manuscripts.

We continued our corpus construction by following Paré et al.'s (2016) advice in terms of narrowing down the first round of results and eliminating irrelevant manuscripts from the corpus. Thus, we screened all titles, abstracts, introductions, theoretical sections, and results of the long-listed manuscripts for inclusion and exclusion (shown in Figure 1).

We excluded manuscripts where the main conceptual basis or focus was not space (e.g., manuscripts that mention space only briefly) and manuscripts that did not provide any empirical illustrations of space concepts (e.g., manuscripts that refer to space concepts but do not provide meaningful illustrations in empirical contexts). We included all conceptual and empirical manuscripts that explicitly wrote about space and provided conceptual elements that are useful for conceptualizing multiple characteristics of space. Moreover, we excluded manuscripts about space that had no direct connection to the phenomena we study in IS (that is, "not IS-related" manuscripts). Here, the criteria for inclusion/exclusion were, according to Paré et al.'s (2016) recommendations, based on eliminating papers that do not address our research aim sufficiently. For instance, this included the elimination of papers that treat space as a common sense phenomenon without indicating an interdisciplinary utility of spatial concepts, do not provide conceptual clarity around spatial features that scholars can use to conceptualize space in IS, are highly abstract and treat space through mathematical equations or a technical language that is adapted for a particular discipline (e.g., physics), or manuscripts that omit the relation between technology and space (e.g., the outer space of the universe, time-space). This process of elimination led to an initial short list of 163 papers.

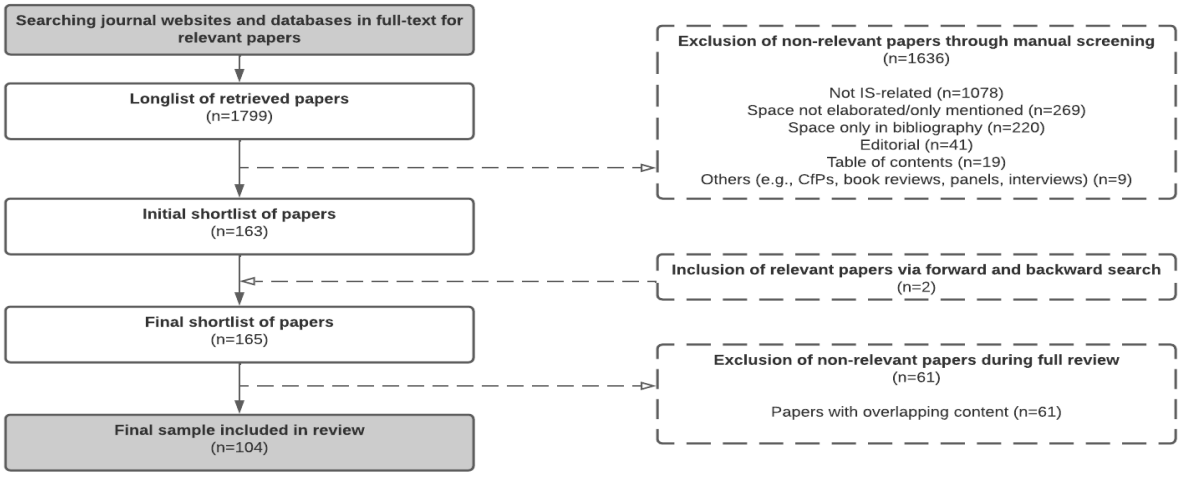

Figure 1. Paper Screening and Selection

The initial short list then became a final short list of 165 relevant manuscripts by applying forward and backward chaining (Okoli & Schabram, 2010; Webster & Watson, 2002). That is, we searched the reference lists of manuscripts in the sample for further relevant work (backward) and used databases such as ScienceDirect to identify papers that cited the found manuscripts (forward).

As a final step, we excluded some manuscripts from the sample due to an overlap of content among the papers. Such overlaps occurred with spatial concepts, their definitions, and universal meanings across the targeted disciplines; For example, *virtual space* had widely and similarly used definitions across several papers, being a space that is created by IT and consumed in virtual settings, such as online forums and social media groups. The final sample consisted of 106 relevant manuscripts, which we then moved forward to the step of data extraction and categorization.

3.3 Data Extraction and Categorization

This step included carefully reading, analyzing, and coding all manuscripts in the final sample. The underlying spirit of our approach toward data extraction and categorization of reviewed literature was essentially inductive rather than mechanistic, as emerging spatial concepts were identified, extracted, and categorized iteratively throughout the review process. Hence, we did not simply derive new concepts directly from the philosophical perspectives; rather, the inductive approach allowed us to identify emerging concepts that were associated with the philosophical perspectives, in a vein similar to what Klein and Myers (1999) and Myers & Klein (2011) did in their development of interpretivist and critical research principles. Following this process, we began: (1) coding key phrases and terms about spatial concepts from the literature, (2) identifying relationships between spatial concepts and underlying ontologies of space, and (3) finding conceptual similarities and differences among the concepts. During the step of extraction and categorization, we followed a practice common in classification, as proposed by Webster and Watson (2002), of preparing a concept matrix that allowed us to categorize emerging insights from each reviewed manuscript into the matrix, together with associated philosophical perspectives and key phrases from specific. We gained insights such as how space is defined, how space is characterized across different disciplines, and what the ontologies of space are.

3.4 Concept-Centric Analysis

To further assess the extracted content of the manuscripts, we mainly followed a concept-centric analysis approach (Watson & Webster, 2002), where it is the emerging concepts that determine the organizing framework of a review (Levy & Ellis, 2006; Salipante et al., 1982; Webster & Watson, 2002). At this stage, we realized that our review approach had successfully engaged with the cross-disciplinary literature on space in terms of what concepts of space to include in our synthesis and how they explicitly or implicitly related to philosophies on space. Our view of a concept incorporated definitions such as: "something conceived in the mind," or "an abstract or generic idea generalized from particular instances" (Merriam-Webster, n.d.). We carefully examined the relationships among identified concepts, underlying ontologies, and meanings of space from the philosophical perspectives to adjust the positioning of concepts in the concept matrix. Finally, the categorization and binding of concepts with philosophical perspectives enabled us to extract spatial themes. Here, we followed an inductive approach (e.g., Gioia et al., 2013) and applied a thematic analysis (Guest et al., 2011) to aggregate identified spatial concepts into spatial themes by using samples (e.g., attributes, features of space) from our literature review (e.g., key phrases). In addition, we remained open to new insights and classifications that could potentially refine our review to account for the conceptualization of space for IS research. To summarize, the following steps provide an illustrative snapshot of the analysis process:

1. Through reviewing our sample of literature on space we identified several different kinds of spatial concepts that inform the complexity and variation of philosophical perspectives. This identification of spatial concepts included concepts that share similar ontologies (e.g., *body space* and *virtual space)* and concepts that supplement each other's perspectives (e.g., *safe space* vs. *discursive space*).
2. The concepts were linked with key phrases (shown in Table 2) from the literature that unveiled characteristics of space (shown in Table 3)—e.g., characteristics such as "materialization," "experiential criterion," "key features," and "distinguishing features."
3. These key phrases were theory laden (Richards & Richards, 1994) as they implied how ontological ideas on space, deriving from the philosophical perspectives, led to a coherent description of the concepts' ontological grounding and a representation of space as an experienced phenomenon. For example, *body space* is described with key phrases referring to spatial behavior and intuition.
4. An interpretation of the key phrases and their relationships with spatial concepts allowed us to build overarching meanings about space, position them philosophically, and generate themes that bind the concepts with characteristics of space.

Table 2. Excerpt from the Concept Matrix

Philosophical perspective	Examples of spatial concepts	Example key phrases	Example references
Formal perspective	Absolute space	Spatial grid, spatial container, measurable boundaries, spatial verifiability, spatial models, representation, mapping, accuracy	Burrough et al, (2015) Rynasiewicz (1996)
	Organizational space	Spatial division, symbolic spaces, spatial possession, office spaces,	Clegg & Koernberger (2006) Weinfurtner & Seidl (2018)
Sociopolitical perspective	Echo chamber	Closed online spaces, epistemic structure, cult indoctrination, superstructure of discredit	Dubois & Blank (2018) Nguyen (2018, 2020)
	Third space	Synthesized form, crosses boundaries, brings together knowledge, practices and discourses	Muller (2009) Pahl & Rowsell (2005)
Phenomenological perspective	Coded space	Technicity, spatial transduction, ontogenetic modulation, material fabric, associated spatiality	Dodge & Kitchin (2005) Kitchin & Dodge (2014)
	Enabling space	Multidimensional, architectural and physical, sociocultural, integrating enabling dimensions	Peschl & Fundneider (2012, 2014) Schmitt (2017)
Intuitive perspective	Body space	Interpersonal, peripersonal, comfort-distance, reachability-distance, long-arm, representation	Kilteni et al. (2012) Lloyd (2009)
	Virtual space	Interaction space, online spaces, virtual presence, spatial translucency, realism	Aslesen et al. (2019) Davis (2004)

Table 2 shows a condensed excerpt from the concept matrix, and the Appendix provides the full matrix with related manuscripts. The excerpts in Table 2 show sample references for each spatial concept as well as key phrases that illustrate how different researchers refer to the same spatial concept but do so by using different key terms and phrases. For instance, the concept of *body space* is explicated by Lloyd (2009) through a conception of space around the body from a neurophysiological perspective—the area individuals maintain around themselves into which others cannot intrude without arousing discomfort or even withdrawal. On the other hand, Kilteni et al. (2012) describe *body space* as a phenomenon that is understood through intrapersonal and peripersonal boundaries in an immersive virtual reality: that is, how space is occupied by our bodies in relationship to others versus the space adjacent to the body that is within arms' reach.

4 The Encompassing Framework for Conceptualizing Space in IS

An encompassing framework allows a scholar to consider different underlying philosophical perspectives that have their own distinguishing characteristics. IS scholars may adopt a philosophical perspective uncritically without being aware that others exist and may thus benefit from becoming aware of other perspectives. Awareness that more than one perspective exists and that those perspectives are in some cases interlinked may be helpful in considering which perspective, theme, or concept is more appropriate for a specific inquiry. For example, an intuitive perspective may yield more insights in an area of human-computer interaction compared with a sociopolitical perspective.

Table 3 presents the framework, with philosophical perspectives on space, four spatial themes, and characteristics that explicate the nuances of space. The framework not only exposes taken-for-granted assumptions of space but also presents the synthesized outcomes from our literature review with conceptual characteristics of space in a coherent way. For example, the framework could be of benefit to a Satnav engineer who tends toward the formal perspective where geographic coordinates are seen as fixed, by exposing her to the possibility of a sociopolitical viewpoint. The accuracy of coordinates is a function of the satellites to which they connect and thus can be influenced by the owners of the satellites.

Table 3. The Encompassing Framework: Philosophical Perspectives, Spatial Themes, and Characteristics

	Philosophical perspectives			
	Formal perspective	**Sociopolitical perspective**	**Phenomenological perspective**	**Intuitive perspective**
Spatial themes / ***Characteristics***	***Representing space***	***Differentiating space***	***Disclosing space***	***Intuitive space***
Materialization	Formal	Social construct	Emergent	Intuition
Experiential criterion	Verifiable	Relational	Unveiling	Innate
Key features	Spatial framing Spatial isolation	Spatial empowerment Spatial productivity	Spatial expansiveness Spatial opening	Spatial intuition Spatial translucency
Distinguishing features	Boundaries Distance Movement	Boundaries Movement	Boundaries Distance	Boundaries Distance Movement

In addition to the linkage between philosophical perspectives and spatial themes, we extracted four conceptual characteristics (shown in Table 3) for each theme. The extraction of "characteristics" was based on inspiration from prior work in the field of IS (e.g., Conboy, 2009; Klein & Myers, 1999; Myers & Klein' 2011) and reference disciplines such as organizational science and management (e.g., Ancona et al., 2001; Weinfurtner & Seidl, 2018). Here, a characteristic is intended to provide a nuanced description that captures a key aspect of space. The characteristics were extracted by the principal author of this paper by focusing on how characteristics of space can: (1) inform the development of a framework or set of principles that encapsulate the key features of a phenomenon, underlying theory or philosophy, or key criterion, and (1) attempt to bring conceptual clarity and cohesiveness to a heretofore ambiguous and polymorphous concept. Subsequently, the characteristics are described as follows.

The *first characteristic* represents the *materialization* (e.g., substance, form, void) of space according to how space is manifested as a phenomenon. The *second characteristic* is the *experiential criterion* that distinguishes how we as human beings experience, perceive, judge, or relate to space. The *third characteristic* represents the *key features* that explicate behaviors of space according to the aggregated concepts that are associated with each spatial theme. The *fourth characteristic* represents *distinguishing features* of space that are typically attributed to a spatial concept yet realized in distinct ways. These features are: (1) *boundaries*, which refer to space as a phenomenon defined by a field of boundaries that are clear, tangible, and stable, or to more formless and fluid kinds of boundaries; (2) *distance*, which refers to space as a phenomenon that either manifests itself in between different entities or enables distance due to a void or gap between two entities; and (c) *movement*, which refers to space as a phenomenon that is associated with movement between entities and within and across boundaries. Some themes incorporated a number of distinguishing features, whereas in some themes, only one or two features were dominantly present.

Additionally, it is worth mentioning that IS scholars often observe phenomena against a background of an assumed ontology of space that is implicit or hidden. The proposed framework offers opportunities for IS scholars to make their spatial assumptions more explicit, to problematize the role of space for their research, and more. In the following subsections, we provide a brief explanation of the framework by highlighting each of the framework's spatial themes, their underlying philosophical perspectives on space, and concepts.

4.1 Spatial Theme 1: Representing Space

The first theme deals with the representing aspect of space, in which space is conceptualized as a framing, mapping, and isolating of a phenomenon that is represented physically: for example, by maps, structures, and models that show physical representations or else virtual representations as in software-based systems.

Twenty manuscripts in our sample addressed this theme, with 10 associated key spatial concepts. The majority of the work was from the disciplines of philosophy, geographical information systems, human-computer interaction, social geography, organizational science, management, and psychology. The *representing space* theme is linked to the "formal perspective" of space (Reichenbach, 2012) as its underlying philosophy, which conceptualizes the *materialization* of space through formal, verifiable characteristics (Shield, 1997) that influence how space is represented for people who are within space (Hubbard et al., 2002). Our literature

review identified the following spatial concepts as the most frequently employed concepts in this theme: *private space* (Burkell et al., 2014; Gruzd et al., 2018); *public space* (Petronio, 2002; Tverdek, 2008); *experimental space* (Bucher & Langley, 2016); *safe space* (Baker & Lucas, 2017); *organizational space* (Clegg & Koernberger, 2006; Taylor & Spicer, 2007); and *absolute space* (Curry, 2008; Jones, 2009). The Appendix gives a full list and description of spatial concepts belonging to this theme.

The experiential criterion of this theme is *verifiability*, which characterizes the experience of space as a "grid" or "container" (Burkell et al., 2014; Gruzd et al., 2018) that contains and frames entities through verifiable boundaries, which in turn are represented through technologies such as GIS (Aldenderfer & Maschner, 1996). For instance, physical locations are framed within geographically verifiable boundaries that underpin the geographical directions provided to users by a direction-giving app that derives its spatial representations of locations from the physical world (Borràs et al., 2014), whereas organizational spaces (e.g., physical offices, meeting rooms) frame their verifiable boundaries through their physical representations (Aslesen et a., 2019).

Moreover, this theme encompasses the key features of *spatial framing*, which conceptualizes the feature of space as the grid or container that frames other entities (e.g., people, objects, places) inside a verifiable space (Bucher & Langley, 2016), and *spatial isolation*, which refers to the feature of how space not only frames phenomena but also isolates them within areas and regions that are designated for particular purposes (e.g., expression of opinions, experiments) (Baker & Lucas, 2017). In addition, this theme shares the distinguishing features of *boundaries*, *distance*, and *movement*. Boundaries are described (Weinfurtner & Seidl, 2018) as both shielding spaces from unwanted events (e.g., providing freedom for people to act in ways in which they would not be able to interact outside those spaces and constraining people from having access to spaces, see, for example, Fantasia & Hirsch, 1995). Distance and movement are interrelated features that take place within verifiable boundaries rather than across boundaries because both features conceptualize how much or little movement is possible within space (Dimitrova et al., 2013). For example, movement is manifested within verifiable boundaries through distance in terms of how far one can move from a certain point to another given the framing and limitations set by surrounding boundaries. Movement could be within a small or large room or it could be registered movement—e.g., in terms of an app that counts the number of steps one takes per day (Daskalaki, 2012).

4.2 Spatial Theme 2: Differentiating Space

The second theme concerns the differentiating nature of space, which conceptualizes space as a socially constructed phenomenon that shapes social processes in a social space. Examples of this include the differentiation of individual or group identities and the production and reproduction of culture and subcultures in organizations.

Thirty-five manuscripts in our sample addressed this theme, together with 15 key spatial concepts. The majority of the papers were from the disciplines of philosophy, organizational science, management, sociology, and social geography. The *differentiating space* theme is linked to the "sociopolitical" perspective of space (Lefebvre, 1991; Massey, 1993, 2005, 2009, 2013) as its underlying philosophy, which conceptualizes the materialization of space as a social construct (Casili & Posada, 2019). As a social construct, space is created through social practices (Cutcher, 2009), sociopolitical movements and trends (McNulty & Stewart, 2015; Nam, 2015), or ideologically driven initiatives such as activism (Courpasson, 2017). Our literature review identified the following spatial concepts as the most frequently employed concepts with this theme: *social space* (Bourdieu, 1993; Lefebvre, 1991; Massey, 2013); *practiced space* (Cutcher, 2009; Richardson & McKenna, 2014); *governance space* (McNulty & Stewart, 2015; Oksanen & Stehle, 2013); *echo chambers* (Kitchens et al., 2020; Nguyen, 2018, 2020); *liminal space* (Shortt, 2015); and *other spaces* (Foucault & Miskowiec, 1986; Sudradjat, 2012). The Appendix provides a full list and description of spatial concepts belonging to this theme.

The experiential criterion of this theme is addressed as relational, which characterizes the experience of space as "liminal" among and in between sociopolitical hierarchies in society and as "embedded fields" within professional practices that change existing social spaces through social processes and political trends (Cutcher, 2009). For instance, the spatial implications (e.g., new working space, making room for work, new routines) of collapsing the boundaries between the home and workspace (Richardson & McKenna, 2014) are liminal, whereas using visual practices at the workplace to change an organizational area (e.g., meeting rooms) into symbolic spaces, both physically and virtually (de Vaujany & Vaast, 2016) is experienced as embedded within the practices.

Moreover, this theme encompasses the key feature of *spatial productivity*, which conceptualizes space as being liminal where new spaces are created based on existing ones in the platformization and de-platformization processes of labor, society, and culture (Casili & Posada, 2019; Nieborg & Poell, 2018), and *spatial empowerment*, which refers to the feature of how space gets produced and reproduced over time through the interplay between human interests and dynamic power structures that

differentiate social identities (e.g., professional identities at work) (McNulty & Stewart, 2015; Oksanen & Stehle, 2013). In addition, this theme shares the distinguishing features of *boundaries* and *movement* as interrelated features. Boundaries are described as making produced spaces distinct, whereas movement results from the creation of new spaces or from changes that are made to existing ones through for instance technological or social interventions (Ciolfi & Bannon, 2005). In this sense, boundaries and movement have an impact on spatial production and reproduction because they both facilitate activities for the production and reproduction of space. At the same time, the literature (e.g., Gamson, 1996; Hirst & Humphreys, 2013) describes how boundaries are removed due to movement across boundaries, where boundaries are characterized as referential due to their formation of culture, identities, and social status. Here, movement is characterized as practiced due to boundary crossing that overcomes barriers for increased knowledge sharing among people in the virtual (Rosen et al., 2007) as well as the physical world (Rodgers et al., 2016).

4.3 Spatial Theme 3: Disclosing Space

The third theme relates to the disclosing nature of space and conceptualizes space as an emerging phenomenon that modulates the unveiling of meaningful spaces. That is, space lives in places and has the ability to unveil different subjective meanings related to actions and happenings, both physical and virtual, through a firsthand experience of space.

Thirty-one key manuscripts in our sample address this theme, together with 16 key spatial concepts. The majority of the manuscripts were from the disciplines of philosophy, human-computer interaction, management, organizational science, and psychology. The *disclosing space* theme is linked to the "phenomenological perspective" of space (Heidegger, 1927/1962; Merleau-Ponty & Smith, 1962; Malpas, 2000, 2012a, 2012b, 2017) as its underlying philosophy, which conceptualizes the materialization of space as an emerging phenomenon (Schatzki, 2017) that is expanded through transduction (e.g., the constant making anew of a domain in reiterative and transformative realities) (Dodge & Kitchin, 2005; Kitchin & Dodge, 2014). Our literature review identified the following spatial concepts as the most frequently employed concepts for this theme: *coded space* (Dodge & Kitchin, 2005; Kitchin & Dodge, 2014); *smart space* (Roelands et al., 2011; Shaw & Sui, 2020); *enabling space* (Peschl & Fundneider, 2012, 2014); *creative space* (Makhaeva et al., 2016; Thoring et al., 2019); *illumination space* (Dul & Ceylan, 2011; Groves-Knight & Marlow, 2016; Martens, 2011); and *disengaged space* (Magadley & Birdi, 2009; Meinel et al., 2017). The Appendix provides a full list and description of spatial concepts belonging to this theme.

The experiential criterion of this theme is seen as *unveiling*, which characterizes the experience of space as either "modulating" humans' perceptions of meaning creation in coded spaces (e.g., coded objects, infrastructures, processes) (Dodge & Kitchin, 2005; Kitchin & Dodge, 2014) or offering "meaningful affordances" for actors to actualize in enabling spaces of innovation (Peschl & Fundneider, 2012, 2014). For instance, creative smart spaces embed smart technologies to disclose the future space of possibilities for meaning creation (Roelands et al., 2011; Shaw & Sui, 2020), thus being, in essence, similar to Heidegger's (1927/1962) idea of *presencing* or Scharmer's (2009) ideas behind the U-theory and transcendental knowledge (e.g., learning from the future as it emerges and discloses itself through the present).

This theme encompasses the key features of *spatial expansiveness*, which conceptualizes space as an intrinsic behavior that expands space into coded spaces that are expressed as multidimensional (e.g., social, virtual, physical) and tightly integrated with embedded information technologies (Dodge & Kitchin, 2005; Kitchin & Dodge, 2014). The other key feature is *spatial opening*, which conceptualizes space as a facilitator for unveiling the meaningfulness of virtual experiences and the sources of where meaning originates (Makhaeva et al., 2016; Thoring et al., 2019). In addition, this theme shares the distinguishing features of *boundaries* and *distance*. Boundaries are characterized as being able to either connect people with places and enable possibilities for action or interaction, or separate them (Malpas, 2000). Distance is characterized (Heidegger, 1927/1962; Malpas, 2000; Schatzki, 2017) in relation to proximity, as something that spatially takes place through indeterminacy. Examples of distance can be found in online users' profiles that present themselves as either being disclosed (unveiling feature) to a network (Lim et al., 2012; Hoffman & Novak, 2013) or being distant to their offline persona (Bruns & Highfield, 2015; Fuchs, 2014).

4.4 Spatial Theme 4: Intuitive Space

The fourth theme has to do with the intuitive nature of space, which conceptualizes space as a formless and fluid phenomenon that transcends physical representations and socially constructed forms of space. That is, space becomes available through our intuition of a place's depth or atmosphere (e.g., how large or small a room feels).

Thirty key manuscripts in our sample addressed this theme, together with 11 key spatial concepts. Most of the manuscripts came from the disciplines of philosophy, human-computer interaction, psychology, management, and organizational science, with a large number from virtual reality (VR) research (e.g., Iachini et al., 2014; Saker & Frith, 2019, 2020; Shin, 2017). The *intuitive space* theme is linked to the "intuitive perspective" of space (Kant, 1781/1999; Janiak, 2016) as its underlying philosophy, which conceptualizes the

materialization of space as intuited or felt via human beings' innate senses (Johnson, 2010), which sense space through immersive feelings (e.g., depth, focus, flow) (Saker & Frith, 2020, 2021). Our literature review identified the following spatial concepts as the most frequently employed concepts in this theme: *body space* (Iachini et al., 2014); *dislocated space* (Saker & Frith, 2019); *coextensive space* (Saker & Frith, 2020); *virtual space* (Davies, 2004); *hybrid space* (Baraderan et al., 2021; Roo & Hachet, 2017); *peripersonal space*; and *extrapersonal space* (Armbrüster et al., 2008). The Appendix provides a full list and description of spatial concepts belonging to this theme.

The experiential criterion of this theme is seen as innate, which characterizes the experience of space as "dislocating" the feelings of spatially "being here" or "being there" at the same time (Saker & Frith, 2019) or as "symbiotic" in terms of merging the relationship between the physical and the virtual as increasingly transformative by making space feel translucent (Saker & Frith, 2020). For instance, 3D representations in e-commerce give the appearance of reality, whereas presence in the context of other virtual spaces (Manovich, 2001) reinforces how an intuition of the separation between the online 2D environment of social media and the immediate physical environment (Bailenson, 2018) causes a feeling of being dislocated among users. Moreover, interaction in the 3D environment of an immersive virtual reality mirrors the physical and virtual environment due to the blended and reduced feeling of physical and virtual boundaries (Saker & Frith, 2020).

Finally, this theme encompasses the key features of *spatial intuition*, which conceptualizes the feature of space as stimulating human beings' intuition for depth in situations where the physical body's presence is no longer crucial for engaging in interaction with one's surroundings (e.g., embodiment of avatars in immersive VR) (Kilteni et al., 2012), and *spatial translucency*, which builds further on the attribute of intuition and focuses on the translucent character of space as formless without objective boundaries (Baraderan et al., 2021). Moreover, this theme shares the distinguishing features of *boundaries*, *distance*, and *movement* as distinguishing features. While some work describes boundaries (e.g., Saker & Frith, 2020) as *melted* into one another and thus experienced as absent, other work (e.g., Slater & Sanchez-Vives, 2016) refers to boundaries as fluid due to the increased sensation of immersion and presence in mixed realities. In relation to boundaries, the features of distance and movement are intertwined in this theme. Here, in contrast to the *representing space* theme, for instance, distance is no longer verified as the interval between two or more geographical points in the physical world, and movement is no longer delimited to bodily movements alone.

5 Applying the Encompassing Framework in Information Systems

We now shift our attention from presenting the encompassing framework to addressing the question of how this framework can be applied by IS scholars. By "IS scholars," we mean authors, editors, or reviewers who may be evaluating research that has a spatial element. First, the framework can be used as a tool for providing IS scholars with a basis for expansive analysis in a particular IS area to see if there are inconsistencies in the way space is defined and interpreted. This application, of course, cannot be done in any mechanistic fashion since each spatial theme is nuanced with respect to its characteristics, concepts, and philosophical perspectives. Second, the framework's explication of spatial themes can help foster a deeper understanding of space for the overall IS field. This deeper understanding could provoke new questions that stimulate journal practices in IS to encourage authors to increase their efforts in re-visioning IS phenomena from a spatial perspective. By "re-visioning" we are referring to Grover and Niederman's (2021) idea of accommodating alternative views of a certain phenomenon. Finally, efforts by authors to increase spatial research in IS are likely to fail without complementary actions on the part of editors and reviewers. Editors and reviewers may be able to use the framework as a point of reference when evaluating and reviewing papers on the topic of space in IS. We explicate each point of application in detail and provide illustrations as follows.

5.1 Applying the Framework for Expansive Analysis in IS

Applying the framework for expansive analysis in IS could yield alternative ideas and modes of thinking, where not only extant understandings of a phenomenon are called into question but spatial ways of viewing a domain are proposed to expand extant understandings of space. The framework and concepts help IS scholars to potentially illuminate new thought-provoking questions and expand new facets of existing problems, The potential of such kind of conceptualization of space is likely to be based on problems or phenomena that are well-known among IS scholars but where perspectives of space have been omitted or implicitly invoked. As Malpas (2017, p. 3) pointed out, scholars across disciplines typically appropriate views around space in an uncritical manner, mentioning spatial concepts without further conceptualization that reveals their value for the scholar's analysis. In summary, the implications of using the framework for expansive analysis are recognized and proposed as: *revealing* emergent aspects of a phenomenon and *illuminating* new questions (see Table 4).

Table 4. Implications of Applying the Framework for Expansive Analysis: Reveal and Illuminate

	Implications of applying the framework for expansive analysis	
	Reveal	***Illuminate***
	• An implication of using the framework for the conceptualization of space may reveal emergent aspects of a phenomenon, which move beyond implicitly invoked conceptions of space that the community already might have engaged in the phenomenon and expand that body of knowledge. • The contrasting and distinct perspectives of the encompassing framework offer IS scholars, fundamental insights about space, which IS scholars can incorporate to reveal emergent aspects for the reconceptualization of a phenomenon.	• An implication of using the framework for the conceptualization of space may illuminate new thought-provoking questions that expose hidden facets of existing problems for a particular domain in IS, which analysis that omits space can address without keeping the hidden facets enclosed for scrutiny. • The rich body of space concepts offers IS scholars, complementary characteristics of space that can allow them to reexamine a domain's phenomenon from a spatial perspective and illuminate new questions that are based on a conceptualization of space.
Illustrations	• Glasmeier and Christopherson (2015) explicated how we should think about smart cities by bringing together a set of seminal articles that examine the discourse around the goals, ethics, potential, and limitations of smart cities. While the authors explicate the different aspects surrounding how we should think about smart cities, the meaning of spatial features, such as boundaries, distance, or movement are not mentioned nor analyzed. • Li et al. (2019) provide a comprehensive overview of the role that GIS should play in the effort to "smarten" a city; they emphasize real-time spatial visualization in a 3D space as a key feature to present movement throughout space and time. While the authors succeed in outlining the relationship between GIS and smart cities—through, for instance, line-based and region-based visualization of spatial data—the underlying assumptions of space are not clear and only invoked implicitly via key concepts such as "location," "region," and "spatial concentration."	
Promoting the conceptualization of space	• Observe a phenomenon, question, or problem that has been largely studied in an area of IS, where characteristics of space are either implicitly invoked, loosely defined, nonreflectively mentioned, or not mentioned at all. • Analyze the observed phenomenon, question, or problem, noting vague assumptions of space, interrelated concepts of space, and their meaning for the study at hand. • Conceptualize space by using the variety of perspectives, themes, and concepts of the encompassing framework. • Illustrate how analyzing the phenomenon, question, or problem from a spatial perspective reveals emerging aspects and illuminates alternative questions.	

Emphasizing the first implication shown in Table 4, authors within IS could use the framework to *reveal* emergent aspects of a phenomenon by analyzing implicitly invoked assumptions of space that a community may have adopted. An expansive analysis of such kind requires communities to engage in a "perspective taking" (Boland & Tenkasi, 1995) and the exchange, evaluation, and integration of new knowledge within and across IS communities. Similarly, the IS field could benefit from incorporating knowledge on space that challenges present aspects of a phenomenon and reveals new ones. For example, in a seminal paper about smart cities, Glasmeier and Christopherson (2015) outlined key aspects of smart-city research with an emphasis on studies that have conceptualized the goals, ethics, limitations, potentials, and technologies of smart cities. The diversity and quality of spatial data throughout the spaces of a smart city are crucial for processing the regional mapping of a smart city. But without a clear conceptualization of smart city boundaries, the regional mapping becomes limited to a simple representation of a city in general (e.g., provided via a map).

However, by conceptualizing the spatial features (e.g., boundaries, distance, and movement) of a smart city deliberately via the formal perspective of the *representing space* theme, we could understand the role of smart city boundaries as verifiable elements of a dynamic container. On the one hand, we could problematize boundaries in relationship to distance in a smart city and say that there are isolated spaces that are not visible on a map because these are *safe spaces* (Baker & Lucas, 2017) for citizens who seek to create spatial boundaries that shield them against discrimination and dignity threats in public. On the other hand, we could go a step further by conceptualizing the same phenomenon (smart city boundaries) from the perspective of the *differentiating space* theme.

Table 5. Illustrative Outcomes from Revealing and Illuminating via a Spatial Perspective

Overarching themes	Sample questions	Examples of captured concepts
Representing space	• Where (e.g., center/periphery) within a smart city does the positioning of smart city boundaries get constructed and how can digital maps distribute them dynamically (e.g., visualize their shape/isolation of spaces)? • What kind of smart mobility happens (e.g., movement) within the boundaries of an isolated space in relation to outside the boundaries of that space?	*Safe space* (Baker & Lucas, 2017); *Protected space* (Mair & Hedenberger, 2014) *Physical space* (Burrough et al., 2015)
Differentiating space	• How do smart technologies alter the boundaries (e.g., deconstruct) of isolated space's identity across multiple isolated spaces, and how can spatial data capture such deconstruction? • What role do smart technologies play in the production/reproduction of isolated spaces and their establishment of new emergent relations between citizens and their surrounding environments?	*Free space* (Polletta, 1999; Rao & Dutta, 2012) *Liminal space* (Shortt, 2015) *Social space* (Lefebvre, 1991; Massey, 2009)

We could deconstruct the representational boundaries of a map by saying that the boundaries of isolated spaces are created through citizens' movement within *free spaces* (Polletta, 1999), where the relationship between movement and technology becomes disrupted due to smart mobility within and across boundaries. This step would allow us to illuminate new questions that supplement Glasmeier and Christopherson's (2015) original study with an added conceptualization of smart city boundaries.

Consequently, this would allow us to *illuminate* (second implication) new kinds of questions that expose and change the spatial assumptions of smart city boundaries as a feature that is constructed/deconstructed by technology in movement (e.g., smart mobility). Questions of this kind would typically emphasize the spatial characteristics of the *representing space* and *differentiating space* themes, such as "where," "through what," "within," "beyond," and "between." Table 5 depicts sample questions together with the captured concepts of the *representing space* and *differentiating space* themes. Other spatial themes could stimulate IS scholars to analyze similar smart-city phenomena (see for instance Loo et al., 2019) from other spatial perspectives that illuminate questions of different kinds.

5.2 Applying the Framework for Re-Visioning in IS

We suggest further that the framework can be used by authors to re-vision IS phenomena. This approach arguably opens new territory, typically through challenging assumptions, and changing rules and standards. Consequently, the re-visioning approach represents a transformational reconsideration of previously held views of a phenomenon and is similar to the "blue ocean transformational" approach advocated by Grover and Niedermann (2021).

For instance, understanding what role echo chambers play in impacting people's self-awareness and offline persona may be a good example of an IS phenomenon (e.g., see Kitchens et al., 2022) that could be re-visioned via a spatial perspective. Considering the spatial features of echo chambers (e.g., boundaries, distance), and how they shape echo chambers can change the way that IS scholars think about echo chambers by initiating a transformational view that would redefine the expansion of echo chambers between online and offline zones. As the phenomenological perspective of space indicates (e.g., Heidegger, 1927/1962; Malpas, 2012b), space "presences" (e.g., makes visible, elucidates) the appearance of a phenomenon from an alternative perspective. This change results from presenting the imagination with ideas that emphasize the spatial relationship with a perceived phenomenon and how a conceptualization of space could affect the experience of that phenomenon (Malpas, 2017). In summary, we articulate the implications of using the framework for re-visioning as: *transforming* current ideas and views of a phenomenon and *redefining* key aspects of that phenomenon (see Table 6).

Emphasizing the first implication shown in Table 6, authors within IS could use the framework to *transform* current ideas and views about a phenomenon by reexamining the assumptions underlying their current ideas and views and using their imagination beyond "typical" ways of articulating ideas and views about an IS phenomenon. A re-visioning of this kind would require authors to go out of their epistemological comfort zones and integrate a spatial perspective. Kim and Mauborgne (2005) present examples similar to the re-visioning approach by deconstructing the attributes of particular businesses and reconsidering how reimagined relationships among components may offer a very new vision of what consumers value.

Table 6. Implications of Applying the Framework for Re-Visioning: Transform and Redefine

	Implications of applying the framework for re-visioning	
Implications	***Transform***	***Redefine***
	• Using the nuances of the framework for re-visioning may support authors' imagination and thus *transform* their current ideas or views about a certain IS phenomenon from a spatial perspective.	• Using the framework for re-visioning may support authors in *redefining* previously overlooked aspects of a domain, problem, or phenomenon that have not been recognized for reconsideration due to the absence of a perspective on space.
Illustrations	• Nguyen (2020) envisions echo chambers from the perspective of what implications echo chambers have for information consumption, and the differentiated impacts social media polarization has on people's public awareness and self-identity. However, current envisioning overlooks conceptualizations of how space is produced/reproduced as an echo chamber, and how spatial characteristics such as boundaries influence the movement into and from the chambers. • Kitchens et al. (2020) articulate how characteristics of platform algorithms and users' online social networks may combine to shape user behavior in echo chambers. While the authors problematize echo chambers and epistemic bubbles successfully from the perspective of social media consumption, their current envisioning bypasses the blurred online/offline zones between two or more distinct spaces for the emergence and expansion of echo chambers.	
Promoting the conceptualization of space	• Examine the constellation of a technology-infused phenomenon that defines the domain or problem. • Use the framework to reconsider the elements of a domain-specific phenomenon, focusing on how a conceptualization of space re-visions the experience of the phenomenon. • Propose a spatial basis for the transformation of ideas and redefine parts of a phenomenon, problem, or domain.	

Similarly, conceptualizing space for the purpose of re-visioning an IS phenomenon will not only open the doors of imagination but also provoke alternative views that emerge due to the deliberate consideration of space. For example, building further on the example of echo chambers studied by Kitchens et al. (2021), our present understanding of echo chambers is delimited to the effect that epistemic bubbles have on information consumption and the differentiated impacts that social media polarization has on people's public awareness and self-identity. Nguyen (2018) confirms that, historically, research on echo chambers has undermined the conceptual clarity of how modern IT affects the emergence, persistence, and spread of echo chambers across social media. The dynamic nature of echo chambers, in combination with the lack of transparency by platform providers, has in turn made it difficult for IS scholars to conceptualize the entangled spaces of echo chambers.

However, when we start re-visioning echo chambers from a spatial perspective, ideas about how spatial characteristics, such as boundaries, influence the *movement* in and from the chamber (e.g., social boundaries in terms of criteria for joining the chamber, leaving the chamber) will transform our current view of echo chambers. On the one hand, we could focus on the *intuitive space* theme and re-vision echo chambers by conceptualizing how echo chambers go from being initially viewed as centralized places on social media to becoming fragmented into *hybrid spaces* (Baradaran et al., 2021; Roo & Hatchet, 2017) that contribute to the individual's intuitive feeling of being within/outside/on the periphery of an echo chamber. The boundaries of an echo chamber are felt as blurred to those who are either within/outside/on the periphery because of the offline-online *distance* individuals experience in the epistemic bubble of an echo chamber (e.g., the initial distance to offline environments such as forums and blogs that enable echo chambers versus the close distance of offline epistemic bubbles at work).

On the other hand, we could go a step further and conceptualize space based on the *disclosing space* theme, which enables us to re-vision the emergence of echo chambers as an implication of *coded spaces* (Dodge & Kitchin, 2005; Kitchin & Dodge, 2014). Here, we can reconsider the ontogenesis of echo chambers (e.g., the development of echo chambers from the earliest stage of establishment) as "transductive" in the sense that echo chambers cast shadows over people's common sense—just like shadows cast over trees or buildings in physical spaces—by enclosing them within *disengaged spaces* (Magadley & Birdi, 2009; Meinel et al., 2017) of demoralizing views. Moreover, in addition to Kitchens et al.'s (2021) conceptualization of engagement with echo chambers as being a process that reflects the shift of one's original epistemic position over time, we can now say that engagement with echo chambers goes beyond social media platforms and information consumption alone. Engagement with echo chambers occurs through movement in and through spaces (offline and online) that have the possibility to enclose or unveil meaningful information about where (e.g., within/outside/periphery/on the fence) the individual is in relationship to an echo chamber, which then allows us IS scholars to understand how, for instance, to build mechanisms that enable the individual to reflect and take a stance toward their positioning.

Table 7. Illustrative Outcomes from Transformation and Redefinitions via a Spatial Perspective

Overarching themes	Examples of redefinitions	Examples of captured concepts
Intuitive space	• Echo chambers possess blurred boundaries that coextend individuals' incidental exposure to ideologies, making it difficult for the individual to feel where in the chamber they are (e.g., how deep in the chamber they are—active member, passive member, potential member) and how far/close the distance is between their own ideologies and the chamber's. • Echo chambers exist in offline/online spaces that are dislocated through fragments (e.g., epistemic bubbles) of the chamber that the members disseminate through movement in and through those spaces (e.g., information consumption on social media versus intuitive exercise of cult mentality in group constellations offline)	*Coextensive space* (Saker & Firth, 2020) *Dislocated space* (Saker & Frith (2019) *Hybrid space* (Baradaran et al., 2021; Roo & Hatchet, 2017)
Disclosing space	• Boundaries of echo chambers emerge through intrapersonal feelings of being falsely protected under tacit rules of engagement (e.g., confidentiality, reserved mentality towards an opinion) with other members of the chamber that disengage the member from their own beliefs. • Echo chambers consist of boundaries that indicate surface and depth (e.g., on top of the epistemic bubble, within the bubble), which from an outsider's perspective, can be perceived to disclose the shared material fabric (e.g., group opinions shared via email, forums, social media, or physical office spaces) of the chambers.	*Disengaged space* (Magadley & Birdi, 2009; Meinl, 2017) *Coded space* (Dodge & Kitchin, 2005; Kitchin & Dodge, 2014) *Illumination space* (Dul & Ceylan, 2011; Groves-Knight & Marlow, 2016; Martens 2011)

Consequently, such a conceptual move would allow us to supplement Kitchens et al.'s (2021) original study, and Nguyen's (2018) call for conceptual clarity with an added conceptualization of space. In turn, this would enable us to redefine the boundaries of echo chambers as well as individuals' feelings of distance toward such boundaries. Redefinitions of this kind would then open the imagination of authors with the support of spatial features deriving from the *intuitive space* and the *disclosing space* themes, such as "spatial intuition," "spatial translucency," "spatial expansiveness," and "spatial opening," which could help authors articulate their re-visioning of echo chambers from a spatial perspective. Table 7 depicts examples of redefinitions together with the spatial features and captured concepts of the *intuitive space* and *disclosing space* themes. Other spatial themes could stimulate an author's imagination to re-vision other IS phenomena such as the emergence and spatial expansion of dark web marketplaces (see for instance Kovalchuk et al., 2021).

5.3 Applying the Framework for Review and Journal Practices

We further suggest that the framework can be used by editors and reviewers for review and journal practices. Applying the framework or review and journal practices is arguably an important task because efforts made by authors to increase the IS body of knowledge on space are likely to falter without equivalent and complementary actions on the part of editors and reviewers. In the interest of supporting editors and reviewers in enhancing journal practices, we suggest that editors serve as central nodes for emerging opportunities to address new issues on space in IS. Over time, we would thus expect that this paper will stimulate the recognition of space through submissions of manuscripts that editors can handle differently depending on the category of the manuscripts (e.g., short paper, empirical research paper, conceptual paper), making it important to equip associate editors and reviewers with sufficient tools for managing manuscripts about space in IS.

Editors can explore ways to develop criteria to identify and process creative yet unorthodox papers about space in terms of content and structure, whereas reviewers will need a lens to rely on when reviewing such papers. Moreover, calls for special issues could also signal interest in space as an innovative topic for the field, as would the submission of "unconventional" papers that gravitate more toward the imagination. In summary, we articulate the implications of using the framework for review and journal practices as: *enhancing the recognition* of manuscripts on space in IS and *enhancing the reviewing* of such papers. Illustrations of such implications are depicted in Table 8.

Table 8. Implications of Applying the Framework for Review and Journal Practices: Enhance Recognition and Reviewing

	Implications of applying the framework for review and journal practices	
Implications	***Enhancing recognition***	***Enhancing reviewing***
	• Using the framework for journal practices can support editors in *enhancing recognition* of calls for papers that focus on space in IS research. • The framework can inform editors through a large body of knowledge on the subject *space* in a cohesive and structured way. This can be used to support special issues and sections on space and IS research in journals. It can also be used to invite papers, extend the formal criteria of research on space in IS, and support the different handling of papers that have the potential to conceptualize space in IS.	• Using the framework for review practices can support editors and reviewers in *enhancing the review* of papers that focus on space in IS research. • The framework can be used as an analytical lens for reviewers who are assigned papers that focus on space in IS research. Additionally, the framework can inform reviewers in their process of screening papers about space and help them provide formative feedback to authors based on knowledge derived from the framework's different components (e.g., spatial themes, concepts, characteristics, and perspectives).
Illustrations	• Future special issues in IS about *remote work* may benefit from focusing on the implications of space for organizing and utilizing location-independent work as a response to the COVID 19 pandemic. This could include papers that conceptualize space for issues regarding co-working spaces, the management of physical spaces, hybrid workspaces, or the theorizing of *boundaries* and *distance* between work and home life. There have been similar special issues in human-computer interaction but without any particular emphasis on the implications of *space* (see Mark et al., 2022). • Reviewers that are assigned papers about space in IS may benefit from using the framework to inform the evaluative aspects of a review on manuscripts that concern space (e.g., definitions, ontologies, concepts, ideas, assumptions) and to take a developmental role by providing feedback that can help authors to elevate their work around space in IS (e.g., conceptualization, theorization, explication, implications of space for their research).	
Promoting the conceptualization of space	• Use the framework to articulate content around space (e.g., definitions, meanings, perspectives, concepts) for special issues of a journal and signal an invitation for papers that conceptualize space in IS. • Use the framework to propose a foundation around knowledge about space in sections of a journal that have an interest in conceptualizing space in IS. • Guide authors who are either writing about IS topics that would benefit from a conceptualization of space or invoking implicit/naive assumptions about space in their papers who would benefit from a clearer conceptualization of space.	

Emphasizing the first implication shown in Table 8, editors within IS may use the framework to *enhance the recognition* of manuscripts that focus on space, whether they are manuscripts that conceptualize space or manuscripts that study it as a phenomenon. Here, the framework could be used in a cohesive and structured way to inform editors about space from a multitude of perspectives that, in turn, would allow them to be consistent when formulating criteria for special issues or journal sections. For instance, this could include organizing special issues on emerging topics such as "remote work in a post-pandemic age" (similar to the special issue proposed by Mark et al., 2022), where a stronger call for papers that conceptualizes the implications of space for remote work could be incentivized. The framework would support editors in scientifically grounding their motivation for the special issue and guiding authors toward submission (e.g., by informing them about the many conceptual considerations around space). Reviewers, in turn, might use the various components of the framework (e.g., themes, concepts, perspectives) to inform their evaluative process regarding IS papers that either conceptualize/study space or have the potential to do so. Reviewers could, for instance, use the framework to easily review IS papers that emphasize space (either explicitly or implicitly) by systematically reviewing definitions, meanings, ontologies, and perspectives, based on the framework's cohesive body of spatial knowledge.

6 Conclusion and Future Research

In this paper, we developed an encompassing framework that supports IS scholars in conceptualizing space in IS. The motivation for our work arose from some key issues that IS scholars might struggle with when writing about or conceptualizing space in IS research, namely a lack of clarity, a lack of boundaries,

and a limited application range. In addition, researchers outside of IS (e.g., Arias, 2010; Malpas, 2012a, 2012b, 2017) have stated that it is important to provoke scholars across disciplines and fields to become more aware of the complexity and rich nuances of space, especially in the digital era (Aslesen et al., 2019; Kitchin & Dodge, 2014). We conducted a literature review (Paré et al., 2016) with a concept-centric analysis approach to develop our framework, based on a body of cross-disciplinary knowledge around space. We presented the framework together with illustrative examples that showcased the implications of the framework for IS scholars and how it can provoke new ways of thinking around their different practices (e.g., authors, editors, and reviewers). This approach helped us contextualize the conceptual utility and relevancy of our framework for the IS field and allowed us to discuss the concrete implications of applying it for expansive analysis and re-visioning of IS phenomena. In this section, we discuss our overall contributions to the IS field by emphasizing how our framework promotes future conceptualizations of space in IS.

6.1 Contributions to the IS Field

First, our work contributes to IS by providing IS scholars with a synthesis of spatial concepts that were extracted from our cross-disciplinary literature review. These concepts can assist scholars in increasing their awareness about the materialization of space from a variety of perspectives, which in turn, can help them conceptualize space based on the concepts' attributes and features. For example, scholars who wish to conceptualize space through a sociopolitical lens might investigate the concepts of the *differentiating space* theme, whereas those wishing to conceptualize spatial boundaries as something physically verifiable might instead conceptualize space based on concepts that belong to the *representing space* theme. The Appendix can be used as a guide for authors interested in identifying the linkages among concepts, themes, and underlying perspectives in order to promote consistent decisions on how to conceptualize space in IS. Additionally, editors and reviewers can also utilize the spatial concepts, especially when framing and reviewing IS papers that deal with space—e.g., by framing their review of space according to a certain ontology or definition that the concepts provide. Finally, the rich nuances and diverse perspectives of the concepts and themes help to resolve the issues of "lack of clarity" and "lack of conceptual boundaries" by attributing clear definitions and ontologies on space, which will make it easier for IS scholars to communicate the conceptual complexity of space in a grounded way (e.g., clarifying the underlying assumptions of space based on a theme or concept in an explicit way, rather than invoking implicit and naive assumptions).

Second, our work contributes to IS by providing IS scholars with two different ways of using the framework: (1) expansive analysis and (2) the re-visioning of IS phenomena. As demonstrated in Section 5, both ways promote a conceptualization of space in supplementary ways. For example, IS scholars who wish to use the framework for expansive analysis might engage more with a conceptualization of space that reveals how current studies rely on implicit assumptions of space that present a naive view about the potential implications that space has for their research, whereas IS scholars wishing to re-vision an IS phenomenon might focus on a conceptualization of space that goes beyond an expansive analysis and redefines aspects of a phenomenon from a spatial perspective. Nevertheless, as revealed by our cross-disciplinary literature review, scholars outside of IS who have studied space extensively (Arias, 2010; Clegg & Koernberger, 2006; Malpas, 2012a, 2017; Taylor & Spicer, 2007; Weinfurtner & Seidl, 2018) have stressed the importance of academic work that provides sufficient guidance to scholars who aspire to studies on space in their own academic disciplines. By demonstrating how the framework can be used for expansive analysis and the re-visioning of IS phenomena, we provide guidance and encouragement for authors in IS seeking to achieve a conceptualization of space based on the framework's components (e.g., themes, concepts, characteristics). In turn, such guidance would also support authors who may have been reconsidering their own theoretical stance and research values, who might be thinking of moving toward a spatially informed research perspective. Moreover, as illustrated in Section 5, the framework can help editors and reviewers in their journal practices. Finally, by targeting the utility of our framework across the above-mentioned ways of using it in IS, our work helps to resolve the issue of "limited application range," providing illustrative guidance that goes beyond a single way of using the framework and promoting the conceptualization of space in IS.

Third, on a more general basis, our work contributes to IS by proposing and treating space not merely as a phenomenon but as a research perspective that can be applied to a wider range of different IS phenomena. For example, our framework allows for the examination of organizational phenomena in IS as well as emerging ones that are situated at intersections of different areas (e.g., echo chambers, smart cities) in terms of spatial characteristics (e.g., boundaries, distance), regardless of how these phenomena are perceived in the IS field itself. In this respect, our framework opens new avenues of inquiry for IS phenomena that so far have been examined from other perspectives, making insights from a spatial

perspective available to other areas of IS research. The proposed framework can thus serve as a new bridge between areas of inquiry in IS, which can help IS scholars substantiate their findings differently through a conceptualization of space, subject to further additions, revisions, and alternative definitions of space made by the IS scholars over time. We believe that our work has certain implications for engaging with the future of IS phenomena (Hovorka & Peter, 2021) by: (1) illuminating new thought-provoking questions that push the envelope of how we understand and cope with IS phenomena over space and time, where thinking spatially makes a tremendous difference in how we understand future IS-phenomena, and (2) using creative language that places an emphasis on opening IS scholars' imagination about space and its relationship to IS phenomena, allowing them to re-vision IS phenomena.

6.2 Limitations and Directions for Future Research

Given the complex nature of space and the weak theoretical and conceptual grounding in much of the existing literature in IS around space, this research makes a necessary first step, providing an encompassing framework that informs and supports IS scholars in their conceptualization of space. There are, however, limitations of our study that can be addressed through future research. One of the limitations of our work has to do with the limitation of evaluating it in an empirical research setting. Our demonstration of the framework relies purely on secondary data (prior studies); while we illustrate the utility of the framework, we hope to see what value IS scholars find in applying the framework to their research projects in the future. Another limitation of our work has to do with the number of spatial themes and concepts identified here; future work could identify additional spatial concepts.

To conclude, we hope that our work will inspire future IS research to engage in a creative yet critical reflection on space in IS research and its implications for research and practice in our discipline. As IS scholars, we all benefit from new creative ways of advancing our research perspectives on complex phenomena such as space, which, in turn, enrich our imagination and understanding of IS phenomena. Hence, we end this paper by providing three brief points that might stimulate future development around our proposed framework. First, we encourage IS scholars to develop the framework further—e.g., by developing new spatial characteristics that elaborate on present features such as boundaries or distance. Second, we suggest that IS scholars find new ways of applying the framework by experimenting with methods for evaluating a range of studies on space by drawing on the various themes of the framework. Finally, we encourage IS scholars to engage in further studies of the framework (e.g., limitations, application range) to advance the research on this topic. We invite IS scholars to embrace the possibilities of developing new ways of understanding, practicing, and theorizing IS phenomena from the multitude of spatial perspectives presented in this paper, perhaps leading to an emerging stream of spatial research in IS.

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Appendix

Table A1. Concept Matrix

Space theme	Spatial concept	Literature stream	Key characteristics	Example references
Representing space	Absolute space	• Philosophy • Geographical information systems	Spatial grid, spatial container, measurable boundaries, spatial verifiability, spatial models	Burrough et al. (2015) Jones (2009)
	Experimental space	• Human-computer interaction	Controlled area, persistent, designated, designed	Bucher & Langley (2016)
	Formal space	• Philosophy	Calculated, logical, clear rules and boundaries, formalized	Fourman & Grayson (1982)
	Institutional space	• Management • Organizational science	Preserved, strict boundaries, governed	Clegg et al. (2013)
	Organizational space	• Management • Organizational science	Divided, hierarchical, moderated, symbolic	Clegg & Koernberger (2006) Weinfurtner & Seidl (2018)
	Physical space	• Geographical information systems • Human-computer interaction	Tangible, clear boundaries, measurable, verifiable through observation	Burrough et al. (2015) Sadoun & Al-Bayari (2007)
	Private space	• Information and Media	Intimate, belongs to the self, reserved, comfort zone	Burkell et al. (2014) Gruzd et al. (2018)
	Protected space	• Management • Organizational science	Highly reserved, controlled, restrictive, belongs to the group or individual	Mair & Hehenberger (2014)
	Public space	•Philosophy •Geographical Information Systems	Open, belongs to the masses, inviting, inclusive, free field	Carr et al. (1992) Habermas (1992/1991) Petronio (2002) Steinberg & Steinberg (2005)
	Safe space	•Human-computer interaction •Psychology	Secure zone, reduces danger, creates a feeling of warmth and inclusion	Baker & Lucas (2017) Clegg et al. (2013) Gamson (1996) Rodgers et al. (2016)
Differentiating space	Compact organizational space	• Organizational science	Organizational proximity: facilitating integration of internal and acquired assets	Nam (2015)
	Cultural space	• Management	Social container, intimate distance, cultural boundaries, open-ended	Hall & Hall (2001)
	Discursive space	• Philosophy • Organizational science	Emerges through dialogues, enables social processes, disruptive, manipulative	Barbara & Gyorgy (2009) Bladth & Nielsen (2013) Ferrara et al. (2020)
	Echo chamber	• Philosophy	Closed online spaces, epistemic structure, cult indoctrination, superstructure of discredit	Nguyen (2018, 2020)

	Free space	• Management • Organizational science	Open, safe, stimulates creativity and reflection	Fantasia & Hirsch (1995) Polletta (1999) Rao & Dutta (2012)
	Governance space	• Management • Organizational science	Reorder relations of authority, boundary spanning, connecting executives and nonexecutives, organizational space in which boards operate and perform	McNulty & Stewart (2015)
	Learning space	• Educational science • Management • Sociology	Active and social engagement, human-centered, remoteness, social presence, positive and negative valence	Brown & Long (2006) Ellis & Goodyear (2016) Tokel & İsler (2015)
	Liminal space	• Management • Organizational science	Not owned, alternative organization, radical difference, surrounding environment, in-between	Shortt (2015)
	Other spaces´	• Philosophy	Heterotopia, disturbing, incompatible, contradictory, transforming, mirror	Chen et al. (2008) Foucault & Miskowiec (1986)
	Practiced space	• Management • Organizational science	Continually evolving entity, precarious, plural process of sociotechnical ordering, performativity	Casilli & Posada (2019) Richardson & McKenna (2014) Scott (1994)
	Smooth space	• Philosophy • Sociology	Practiced, open-ended, nonlinear, intensive, haptic deterritorializing the organization's authority	Deleuze & Guattari (1988) Tamboukou (2008)
	Social space	• Philosophy • Social geography	Social transformation, organizational change, production and reproduction of communities, emergence of norms and values	Bourdieu (1993) Lefebvre (1991) Massey (1993, 2005, 2009, 2013)
	Striated space	• Philosophy	Addresses processes in life, gridded, linear, metric, optic	Deleuze (1994)
	Transitional space	• Organizational science	Physical manifestation of liminality, transitory stage in rituals, state of blurred boundaries	Kociatkiewicz & Kostera (2015)
	Triple helix space	• Organizational science	Hybrid organizations, bilateral interaction, blurred boundaries	Etzkowitz & Ranga (2015)
Disclosing space	Architectural space	• Computer science	Buildings, offices, designed rooms and places	Streitz et al. (1998)
	Ba/basho	• Philosophy • Management	Shared space, emergent, subtle, tacit, reformative	Nonaka et al. (1998) Scharmer (2007)
	Coded space	• IS/Human-computer interaction • Philosophy	Technicity, spatial transduction, ontogenetic modulation, material fabric, associated spatiality	Ciolfi & Bannon (2005) Dodge & Kitchin (2005) Kitchin & Dodge (2014)

	Cognitive space	• Philosophy • Psychology	Reflective, emergent, blurred boundaries, metaspace	Scharmer (2007)
	Collaborative space	• IS/Human-computer interaction	Interpersonal trust formation, digital infrastructure, facilitates team bonding and communication	Rusman et al., (2010)
	Creative space	• IS/Human-computer interaction	Unfolds potential for participation, co-design activities take place, facilitates structure and creative freedom	Makhaeva et al. (2016)
	Design space	• IS/Human-Computer Interaction	Stimulates form, creativity, action and reaction, collaborative, enables processes	MacLean et al. (1991) Muller (2003)
	Digital space	• IS/Human-computer interaction	Cyber-physical systems, intranets, sociomaterial	Hutton & Fosdick (2011)
	Disengaged space	• Philosophy • Organizational science	Isolated environments, protected, confidential, reserved	Magadley & Birdi, 2009 Meinl et al. (2017)
	Electronic space	• IS/Human-computer interaction	Network of hardware, electronic media settings, mediates software systems, cyberspace	Anders (2001) Carroll et al. (2001)
	Emotional space	• Psychology	Emotive, emerges through feelings, both interpersonal and intrapersonal	Tato et al., 2002
	Enabling space	• IS/Human-computer interaction • Philosophy	Multidimensional space, architectural and physical, sociocultural, integrating enabling dimensions	Peschl & Fundneider (2008, 2012, 2014)
	Illumination space	• IS/Human-computer interaction • Organizational science	Facilitated through movement and processes, impact on creativity and innovation	Dul & Ceylan (2011) Groves-Knight & Marlow (2016) Martens (2011)
	Media space	• IS/Human-computer interaction	Digital infrastructure, embedded in physical space, creates possibilities	Bly et al. (1993)
	Mental space	• Philosophy • Psychology	Headspace, psychological, mental model, intrapersonal	Sweetser et al. (1996)
	Smart space	• IS/Human-computer interaction	Internet of things, connecting nodes, diversification, composable	Gabrys (2014) Glasmeier & Christopherson (2015) Roelands et al. (2011)
Intuitive space	Body space	• Philosophy • Human-computer interaction	Interpersonal, peripersonal, comfort-distance, reachability-distance, spatial behavior	Iachini et al. (2014) Janiak (2016) Kant (1999) Kilteni et al. (2012)
	Coextensive space	•Human-computer interaction • Philosophy	Symbiose, extends other spaces, shared, immersive, requires presence	Saker & Frith (2020)
	Dislocated space	• Human-computer interaction • Philosophy	Mediates detachment, transparent, moves fluidly	Saker & Frith (2019)

	Extrapersonal space	• Psychology	Surrounding, cognitive, exists in between the self and others, locational	Armbrüster et al. (2008) Butkovic et al. (2019)
	Hybrid space	• Human-computer interaction • Organizational science	Combined spaces, extensive, overlapping settings and environments	Baradaran et al. (2021) Roo & Hachet (2017)
	Immersive space	• Human-computer interaction • Psychology • Philosophy	Increases presence, absorbing, facilitates engagement, attentive	Cheng et al. (2014) Crabb et al. (2019) Ke et al. (2020) Radianti et al. (2020)
	Peripersonal space	•Psychology	Exists in between people, distance is created, feeling a gap	Armbrüster et al. (2008) Kim et al. (2017)
	Relational space	• Geographical information systems • Management	Relative, reinforces happenings and events, is stimulated through relations between people, places, and objects	Dimitrova et al. (2013) McQuire (2008)
	Shared space	• Organizational science • Psychology	Exists through interaction, is designated to people	Borràs et al. (2014) Carr et al. (1992) Gieseking et al. (2014) Kim et al. (2007)
	Third spaces	• Organizational science • Social geography	Synthesized form, crosses boundaries, brings together knowledge, practices, and discourses	Bhabha (1994a) Bhabha (1994b) Evanoff (2000) Kellogg (2009) Muller (2009)
	Virtual space	• Human-computer interaction • Management • Philosophy	Interaction space, online spaces, virtual presence, spatial translucency	Aslesen et al. (2019) Cram et al. (2011) Davies (2004

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