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Short Paper

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Abstract

The growing relevance of algorithmic systems, including artificial intelligence, for processes of value creation raise theoretical and practical interest in the conceptualization of actorhood and the balancing of human and technological agencies within socio-technical ensembles. Prominent theories of the IS discipline still reflect a human-centric conceptualization of agency, which we deem challenged by advances in machine learning technology. We therefore motivate a revised theorizing of the concept of agency with a socio-technical lens. For that, we apply an inductive top-down theorizing approach. In this short paper, we present the first inductive step by describing tensions, oppositions and contradictions in the discourse on agency in IS literature of the last 30 years in the AIS Senior Scholars' Basket of journals. The preliminary findings uncover a conceptual and ontological incoherence surrounding the concept of agency in IS scholarship, and a gap between reviewed publications and the agency claims of algorithmic systems.

Keywords: Agency, artificial intelligence, socio-technical system, theorizing, human-algorithmic ensemble

Introduction

With advancing capabilities for autonomous action and complex interaction, algorithmic agents progressively contribute to organizational task-fulfillment and value creation in an increasingly self-sufficient manner (Tuunanen et al. 2019). While the complementarity of human and technical capacities promises significant economic gains (Lehrer et al. 2018), growingly sophisticated and autonomous algorithmic systems also pose challenges to human agency, freedom and control (Benbya et al. 2021; Kane et al. 2021). Considering the extent of resources currently vested in the advancement of autonomous and self-learning artificial intelligence (AI) (Shirer et al. 2019), the development of AI increasingly capable of self-sufficient, goal-oriented actualization of intended outcomes and self-improvements without human intervention (van Rijmenam and Logue 2021) is foreseeable. While the impact of technology on social behavior has long been recognized, respective technical advances imply a renewed interest in the concepts of actorhood and agency.

The concept of *agency* has traditionally been discussed in relation to human properties such as free will, intentionality or reflexivity and the question how human behavior is affected by social and material structures including technology (e.g. Leonardi 2011). Agency of technical artifacts has priorly been discussed in IS scholarship. However, pertinent work displays a human-centric tendency, often limiting technical agency to structural properties (e.g. Leonardi 2013). By viewing technology either as a static, inanimate object or as a context for human interaction (Andersen et al. 2016), human-centric accounts of technical agency, so we argue, do not do justice to the advancing capacities of algorithmic systems. Arguing that from a user-perspective it does not matter *how* respective systems gain such capacities, this research includes both sophisticated instructed algorithmic systems (symbolic AI) and self-learning systems (machine-learning based AI) in its consideration of algorithmic systems. IS scholarship urges the need to recognize the agentic nature of algorithmic technologies with proactive, cooperative and context-sensitive capabilities, requesting for clarification of their agency (e.g., Murray et al. 2021). However, focusing on the aspects of systems that warrant a discussion of their agency, respective work tends to be artifact-centristic, giving less attention to interacting manifestations of agency between social and algorithmic entities. In other words, human- *or* technology-centric accounts weaken a synergistical consideration of instrumental and humanistic outcomes in socio-technical systems, as problematized by Sarker et al. (2019).

As organizational implementations of algorithmic technology involve a balancing act between human and technical agency (Asatiani et al. 2021), we suggest applying a socio-technical lens on agency within human-algorithmic ensembles by adhering to the socio-technical paradigm. The socio-technical paradigm acknowledges the interdependencies and continuous interaction between technical and social elements in human-algorithmic ensembles (Dolata et al. 2021) proposing that both components ought to be regarded as *equivalent* in importance and conceptual depth (Beath et al. 2013). In contrast to a sociomaterial account, the socio-technical paradigm upholds the ontological distinction of technical and social components as separate entities (Asatiani et al. 2021) and therefore warrants the consideration of a distribution of agency amongst human and non-human actors within a socio-technical system. Moreover, it allows for the consideration of potentially shifting distributions, dynamic emergence and different manifestations of agency within human-algorithmic collectives, so we argue. We begin with a general assessment of how the agency concept is used in IS literature irrespective of the nature of the agentic subject to understand how agency can generally be conceived. We then discuss the implications of respective conceptions for the question of whether algorithmic entities can have agency and derive a socio-technical perspective on agency, motivated by the reasons listed above. We hence set out to answer the following research questions:

RQ1: How is the concept of agency currently applied in IS literature?

RQ2: How can the concept of agency be theorized to enable a consideration of distributed agencies of human and algorithmic entities in socio-technical systems?

Working towards the described goal, we follow an inductive top-down theorizing approach as suggested by Shepherd and Sutcliffe (2011) and for example applied by Leidner and Tona (2021a). The inductive top-down approach offers a method for literature-based theorizing of phenomena for which divergent and contradictory perspectives and explanations are found within the literature. This short paper presents the preliminary results of a systematic review of literature to identify perspectives on agency currently represented in leading IS scholarship, answering RQ1. The results of this paper are therewith foundational for the theorizing intended in RQ2; RQ2 will be addressed in the further development of the research project.

Starting out with 190 candidates, a total of 27 filtered articles from the AIS Senior Scholars' Basket of Journals were reviewed, spanning the time from 1990-2022. The preliminary findings present multiple angles of agency-related IS research and three prominent perspectives on the conceptualization of agency. We discuss the identified conceptual and ontological incoherence surrounding the concept of agency. Additionally, we motivate a theorizing of agency through the socio-technical lens to strengthen the conceptual understanding foundational to the growing discourse on the management and governance of algorithmic systems.

Background

Agency and Algorithmic Systems in Information Systems Research

Information systems research has seen a long-standing debate on the role and nature of agency in navigating human action, including the use of technology or social behavior driving organizational change (Robey et al. 2013). Rooted in a social science perspective, early scholarship focuses on agency as a human property, defining agency as the human ability to – to a more or lesser degree – freely appropriate, reinvent or work around social structures and technology to achieve their goals (Giddens 1984). The focus on agency as a human property has been contrasted by post-humanist perspectives. Actor Network Theory recognizes anything as a potential actor; but its indeterminacy of the actor has been criticized for rendering ANT unsuited to study questions of agency (Greenhalgh & Stones 2010). Others acknowledge the notion of technical or material agency (e.g., Leonardi 2011; Pickering 1995). While earlier notions of material agency defined it as a technology's capacity to have an affording or constraining effect on human behavior, such a flat theory of material agency is increasingly questioned (Jansen 2016) as recent advances in algorithmic technologies force us to reconsider technology's capacity for reflective, projective and goal-oriented action (Benbya et al. 2021).

In that context, recent AI technologies challenge the assumptions dividing the domains of human capability and machine capacities (Schuetz and Venkatesh 2020). With advancing abilities of autonomous action, emotional intelligence, conversation, creativity, control and choice, AI technology enters domains that were previously exclusive to humans such as product development, management or emotional support. AI technologies therewith urge an advancement of our understanding of how the interaction between human and algorithmic actors "provides a stabilizing force, a coevolution of work, or the emergence of novel forms of work and organizing" (Benbya et al. 2021, p. 2). Organizational AI implementation involves a balancing act between human and AI agency in which the parties' power balance will be increasingly equalized by technological advancements (Asatiani et al. 2021). This emphasizes the importance of a discourse on managing and governing organizationally employed algorithmic systems (e.g., Berente et al. 2021; Li et al. 2021). A foresighted discussion of the organizational implications of agentic algorithmic technologies presents opportunities for information systems research to contribute to a growing conversation on topics related to AI management and governance, and posits the field's socio-technical paradigm to consolidate existing technology- and management-focused perspectives.

The Role of the Socio-technical Paradigm in Information Systems research

The socio-technical perspective is rooted in the insights that neither a social, nor a technical view alone suffices to account for the complex relationships between people and technology (Beath et al. 2013). Rather than granting a privileged position to either, the socio-technical perspective advocates a *mutual interdependency* between *social components* and *technical components* (Dolata et al. 2021). It describes their connection as *iterative* and *reciprocal* (Lee 2004), with both engaging in *joint optimization* for the creation of a productive socio-technical system (Sarker et al. 2019). In this, social and technical components ought to be regarded as *equivalent* in impact and importance (Beath et al. 2013).

The socio-technical paradigm has been used to study "almost all major topics of interest in the IS discipline", including organizational change and human-computer interaction (Sarker et al. 2019, p.699), or automated decision-making and fairness (Dolata et al. 2020). Sarker et al. (2019) acknowledge it as one of the foundational paradigms for the IS discipline, serving the fields' distinctiveness and ability to engage with emerging topics from reference disciplines. Noting a dominating focus on instrumental outcomes (e.g., economic gains) in some segments of the IS community, the authors urge to re-align with the socio-technical paradigm by intensifying the synergistical consideration of instrumental and humanistic outcomes. For the context of organizational implementations of algorithmic systems, this mirrors suggestions of a socio-technical perspective as the primary tool for the balancing act between human and algorithmic agencies (Asatiani et al. 2021) and motivates its employment to complement purely managerial- or technology-focused research, as suggested by this research.

The rising impact of technology on individual and social behavior has spurred an evolution of the conceptual understanding of agency in the past thirty years. Continuing this process, advancements of algorithmic technology challenge traditional human-centric perceptions of agency, motivating our interest in how human and algorithmic entities can be described as equitable actors within socio-technical systems.

Because of its emphasis on the equal treatment and interactivity of social and technical elements, we suggest the socio-technical paradigm as a suitable lens to inform respective theorizing.

Method

Our research follows an inductive top-down theorizing approach, which has been described by Shepherd and Sutcliffe (2011) as a well-suited method for the development of new theories in contexts characterized by "tensions, oppositions, and/or contradictions among divergent perspectives and explanations of the same phenomena" (p.361). This is the case with agency, which is addressed by a multitude of disciplines and theories, spanning several time periods and ontological practices. Inductive top-down theorizing begins with the consideration of data (top-down theorizing), consisting of the information contained in the literature on a phenomenon, to deduce perceived tensions, oppositions and/or contradictions (sensory representations). Based on these sensory representations, the theorist then derives conceptual representations, referring to abstract constructs and statements of relationships between these constructs, from which the new theory emerges (inductive theorizing) (Leidner and Tona 2021b). The preliminary results presented in this short paper describe the first step of a deductive literature review, thereby answering RQ1. RQ2 will be element of the research project's further development; an outlook of future theorizing is given in the discussion section.

The consulted literature was systematically selected from publications addressing the concept of agency in the AIS Senior Scholars' Basket of Journals using Scopus's advanced search. The concentration on publications of the Basket was motivated by our intention to study the impact of agency-related research within the IS community. Intending to capture the evolving conceptual understanding and application of the agency term, we selected for articles that focused either on the development of the agency concept or used the same as a tool for examination of another phenomenon. The search for "agency" in title, abstract and keywords yielded a total of 190 candidate articles. Based on abstracts, the selection was narrowed down, excluding articles in which the term "agency" referred to the homonym of a public institution, as well as articles using the term in a managerial context (e.g., pricing and innovation agency, principal-agency theory). From the resulting 47 candidates, those with only a peripheral mentioning of agency without conceptual reflection were removed, leading to 27 articles in the final selection, which comprised papers with a pertinent conceptual consideration of *agency*.

To capture the interest of existing research, we first examined the different angles towards the concept of agency taken by the reviewed literature. Subsequently, we analyzed the articles' conceptualizations of agency to identify prominent perspectives, respective underlying assumptions, and potential conflicts. The findings were synthesized into a conceptual overview of existing forms of agency considered in IS scholarship. This paper presents the preliminary conceptualization based upon which we will continue the process of theorizing about distributed agencies of human and algorithmic entities in socio-technical systems.

Preliminary Results

Within IS research multiple angles towards the concept of agency can be identified. Table 1 presents an overview over the approaches found within the reviewed literature, differentiated by their respective research interest. IS researchers engaging in discussions of agency largely take a philosophical (e.g., Ågarfalk 2020; Oberländer et al. 2018), analytical (e.g., Chae and Poole 2005; Leonardi 2011), ethical/legal (e.g., Liu et al. 2001), psychological (e.g., Teubner et al. 2015) or practical angle (e.g., Lehrer et al. 2018).

IS literature with a philosophical focus defines foundational concepts relevant to the agency discourse, such as actorhood (Oberländer et al. 2018), or constitutive properties of digital agency (Ågarfalk 2020). Literature with an analytical focus is less concerned with foundational definitions but theorizes about the interactivity of material and human agency, for example drawing on metaphors of a layering (Chae and Poole 2005) or imbrication of agencies (Leonardi 2011). Scholarship focusing on legal and ethical aspects discusses respectively desired outcomes and enforcement possibilities, such as the idea of norm-based agency (Liu et al. 2001). Lastly, psychology-focused literature investigates the psychological effects of perceived agency of computerized agents on human behavior (Teubner et al. 2015) and practice-oriented research examines the economic potential of human-technology collaboration, such as service innovation through process automation (Lehrer et al. 2018).

	Philosophical	Analytical	Ethical/Legal	Psychological	Practical
Research Interest	Definition of concepts and relations e.g. consciousness, intentionality, actorhood	Understanding (mutual) effects of materiality, human agency and social structure	Legal/ethical implications of agentic IS	Perception and (psychological) effect of agentic IS e.g. anthropomorphism	Realization of economic potential of human-technology ensembles
References	Ågarfalk 2020; Baird & Mairuping 2021; Oberländer et al. 2018	Beaudry & Pinsonneault 2005; Besson & Rowe 2012; Chae & Poole 2005; Cornford & Shaikh 2010; Ellway & Walsham 2015; Ferneley & Light 2008; Goh et al. 2011; Jensen et al. 2009; Jonsson et al. 2018; Leonardi 2011; Nevo et al. 2018; Robey et al. 2013; Sergeeva et al. 2017; Venters et al. 2014	Liu et al. 2001	Teubner et al. 2015	Bernadi 2017; Cecez-Kecmanovic et al. 2014; Chu & Robey 2008; Kim et al. 2012; Lehrer et al. 2018; Rossi et al. 2019; Silver 1990
Table 1. Focus of Agency-related IS Literature					

Partially corresponding to the differences in focus (Table 1), the literature review revealed an incoherence of IS scholarship in the conceptual definition of agency (Table 2). Incoherence concerns the constitutive elements of agency, reflecting varying presuppositions of agenthood. This implies differences in the perspectives' potentiality to recognize an agency concept beyond human agency. Three conceptual perspectives on agency can be identified: agency as *entity property* constituted by an entity's qualities, agency as emergent in *entity behavior*, and agency as emergent in *collective interaction* between human and non-human actors. Table 2 at the end of this section offers an overview over the three perspectives and their constitutive elements of agency; exemplary references from the literature review are noted.

As a first perspective, the notion of *agency as entity property* considers agency as an inherent quality of an entity, contingent on specific qualities or attributes. Agency is therefore relatively static and restricted to entities with the potentiality to possess respective attributes. Authors taking this perspective frequently refer to Giddens' understanding of agency as lying within individuals' ability for intentional, reflexive and purposeful action (Giddens 1984). Frequent reference is also taken to the theory of temporal agency by Emirbayer and Mische (1998). Agentic properties described in the reviewed IS literature include *free will and free choice, consciousness and reflexivity* (Bernadi 2017; Nevo et al. 2018), *intentionality and goal-orientation* (Bernadi 2017). Agency is also used to refer to the *structuring properties of (technology) materiality* (Bernadi 2017; Sergeeva et al. 2017), or to an entity's *human appearance* (Teubner et al. 2015).

The second perspective of *agency as entity behavior* situates agency within entities' actions. Notions of behavioral agency found in reviewed IS literature include the definition of agency as *effective behavior* (Chae and Poole 2005) or *conditional behavior*, referring to the capacity for a specific type of action such as independent and autonomous action (Lehrer et al. 2018; Liu et al. 2001), intentional action (Beaudry and Pinsonneault 2005; Leonardi 2011); or social/symbolic (inter-)action (Ågerfalk 2020; Liu et al. 2001). Behavioral agency can also take the form of *power behavior*, visible in instances of task delegation (Baird and Maruping 2021) or the embedding of intentions within an entity or process (Silver 1990).

Agency as collective interaction departs from an entity-oriented conceptualization of agency. This third perspective discusses agency as a phenomenon that is relationally constituted within a socio-technical ensemble or entanglement (Oberländer et al. 2018) rather than the attribute of a single entity's nature or behavior. To illustrate, Cecez-Kecmanovic et al. (2014) take up a performative and sociomaterial perspective, viewing instances of agency as emergent, relational effects of intra-actions in "heterogeneous and continually reconfiguring (…) actor-networks" (p. 582). Rather than assigning agency to an actor, the authors describe agential cuts as the consequence of the rise of agency, reversing the ontological origin of

actors and agency. Venters et al. (2014) likewise adopt a performative perspective and describe sociomaterial agency as a "temporally enacted process of sociomaterial entanglement" (p. 931). Reviewed publications that locate agency within collective interaction primarily express a sociomaterial, rather than a socio-technical account of agency. While the performative sociomaterial perspective conceptualizes technologies as equivalent actors and acknowledges "the rise of competing agency" within IS actor-networks, "the language of performative perspective presents a barrier to their use in practice" (Cecez-Kecmanovic et al. 2014, p.581).

Locus of Agency	Constitutive Elements of Agency	References
Entity property: Agency is quality of entity	- Free will/choice - Consciousness - Reflexivity - Intentionality - Materiality - Human appearance	Bernadi 2017; Chu & Robey 2008; Ellway & Walsham 2015; Ferneley & Light 2008; Goh et al. 2011; Jonsson et al. 2018; Leonardi 2011; Nevo et al. 2018; Robey et al. 2013; Sergeeva et al. 2017; Teubner et al. 2015
Entity behavior: Agency is emergent in action of entity	- Enactment of effect - Autonomous action - Independent action - Intentional action - Symbolic (inter-)action - Delegation	Ågerfalk 2020; Baird & Maruping 2021; Beaudry & Pinsonneault 2005; Bernadi 2017; Besson & Rowe 2012; Chae & Poole 2005; Jensen et al. 2009; Lehrer et al. 2018; Liu et al. 2001; Rossi et al. 2019; Silver 1990
Collective interaction: Agency is collective property in socio-technical system	- Entanglement of ontologically separated social and technical agency - Sociomaterial agency as emergent property of socio-technical systems	Cecez-Kecmanovic et al. 2014; Cornford & Shaikh 2010; Kim et al. 2012; Leonardi 2011; Oberländer et al. 2018; Venters et al. 2014
Table 2. Conceptualization of Agency in IS Literature		

Discussion

The review of literature indicates that IS scholarship represented in the AIS Senior Scholars' Basket of journals discusses technological agency mostly with reference to its impact as a structuring force on processes of IS development (Chae and Poole 2005), IT reinvention (Nevo et al. 2018), technology use (Sergeeva et al. 2017) or organizational routines (Leonardi 2011). While some authors recognize the emergency of increasingly agentic IS and explicitly challenge the agentic primacy of human agents (e.g., Ågerfalk 2020; Baird and Mairuping 2021; Lehrer et al. 2018; Oberländer et al. 2018), the reviewed articles disagree over the attributes that would render a technology agentic.

Several authors apply distinct definitions to human agency and material agency, expressing an asymmetrical agency concept. While recognizing non-human agency, this suggests a constitutive difference between human and non-human agency. Frequently, such constitutive difference is translated into a qualitative difference (Baird and Mairuping 2021) as many imply a unidirectional relationship between human and material agencies with people being capable of maneuvering around the materiality of technology. This portrays people (and social structures) as flexible and dynamic, and technology as inflexible and static. Reviewed papers that acknowledge agentic technology, too, uphold a primacy of human agency (Leonardi 2011) or a narrow definition of non-human agency within the act of task delegation (Baird and Mairuping 2021). None of the publications considered the possibility of an algorithmic system as equal actant in a human-AI interaction. While the question whether and when AI will attain capabilities of emotional intelligence, reflectivity or creativity remains to be answered, a principled assumption of a primacy of human agency inadequately captures the empirical reality of recent technological developments. As illustrated in Table 2, conceptualizations of agency as a collective property in socio-technical ensembles do exist. However, these mostly express a sociomaterial, rather than a socio-technical account. As motivated

above, a sociomaterial approach is ill-suited for the assessment of the rise and (shifting) distribution of human and technical agency as it rejects the ontological separation of social and technical actors.

The reviewed literature mostly leaned towards a sociology-inspired perspective on agency. While closest to the practical perspective, a technical consideration of algorithmic agency is not in the focus of agency-related IS literature (Table 1). A comprehensive analysis of technical attributes defining algorithmic agency, and of the dynamics through which such attributes are attained or expressed by a system, appears foundational to questions of managing, controlling, and designing algorithmic agency. Moreover, none of the papers discusses the concept of agency in the specific context of advanced artificial intelligence, including a forecast of systems likely to arise in the mid-term future with sophisticated agentic capabilities such as self-learning, intentional goal-attainment or self-adaption and self-recreation (Benbya et al. 2020). However, the possibility of rapid technological developments suggests the importance to consider managerial and organizational implications of such advanced AI agents ahead of time. This includes a technical discourse on the attributes and dynamics that differentiate respective systems from other technologies commonly discussed in IS research.

Based on these findings and identified gaps, we propose a socio-technical theorizing of agency in human-algorithmic ensembles. A socio-technical perspective ought to equally consider human and algorithmic agency with both being, whilst not necessarily symmetrical in their manifestation, equal in importance and conceptual depth (Beath et al. 2013). This invites a complementation of the prominent sociology-inspired discourse with a technical perspective on the attributes and working mechanisms of algorithmic agency. Furthermore, a socio-technical perspective focuses on the interaction between social and technical elements (Dolata et al. 2021), motivating a nuanced conceptualization of agency which captures how agencies emerge, manifest and operate in human-algorithmic ensembles. We therefore aim for a concept which on the one hand details the technical attributes that render technology agentic. On the other hand, the model should place algorithmic agency within a systemic context by capturing relevant dynamics to the rise, fall and intra-activity amongst multiple agencies instantiated within a socio-technical ensemble.

The orchestration of human-algorithmic ensembles warrants a differentiated consideration of human and technical agencies. A strengthened conceptual understanding of agency that can capture the increasing capabilities of algorithmic technologies is therefore foundational for the management and governance of algorithmic systems, suggesting the practical relevance of the here presented findings and their further development. Our findings include some limitations due to the chosen focus on publications from the field of Information Systems and more narrowly from the AIS Senior's Basket of Journals. This choice was motivated by our intention to first concentrate on the agency discourse within the IS community. Extending the scope of considered literature to adjacent fields of research or to a broader range of IS outlets can raise additional perspectives on agency and will be part of the research's further development. Moreover, our search was limited to articles using "agency" in title, abstract or keywords. Future research could improve our findings by applying a full-text search to identify additional publications of relevance. Following our intention to describe how agency can be understood, we did not focus on identifying the technical attributes that render algorithmic entities agentic, suggesting an additional point for further work to advance the presented research.

Conclusion and Outlook to Further Research

We motivate a socio-technical theorizing of agency to capture distributed agencies within human-algorithmic ensembles. This research-in-progress presents the first step of deducing data on existing conceptualizations of agency from leading IS literature of the last thirty years. The systematic literature review evinced a general conceptual and ontological incoherence surrounding the concept of agency in IS scholarship. We identify multiple angles of agency-related IS research differentiated in research interest and focus. Moreover, we describe three prominent perspectives on the conceptualization of agency, which differ in their recognition of and potentiality to recognize an agency concept beyond human agency. In a next step, we will, first, refine the presented findings by adding additional literature to our review and by emphasizing the ontological differences between each perspective in our analysis. We will then proceed with the step of inductive theorizing as described in the methodology to answer RQ2.

The specific contribution of this research in progress is to systemize existing conceptualizations of agency within IS research and to motivate a revised theorizing adherent to the field's socio-technical paradigm.

After its completion, the research will provide a differentiated understanding of agency within human-algorithmic ensembles. By strengthening our conception of agencies of human and algorithmic entities, the research will support a foresighted discussion of the organizational implications of agentic AI technologies and offer practice-relevant implications for the design and employment of algorithmic systems.

Acknowledgements

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