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Digital work and organisational transformation: Emergent Digital/Human work configurations in modern organisations

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ABSTRACT

Workplace technologies are more central to working in organisations than ever before. These technologies began as instrumental aids to support office work of individuals but have since also become the basis for social interactions and community building in organisations and more recently become able to perform managerial roles with the use of advanced AI capabilities. Our call for papers to this special issue invited original studies to go further and advance our thinking on the strategic implications of this layered evolution of workplace technologies on work and the structure of organisations. In this introduction, we synthesise the main themes from the special issue, and also ongoing dialogues with the growing community at the regular AIS / IFIP 9.1 workshop on the Changing Nature of Work. A key observation is that the work involved in *configuring* emergent Digital/Human configurations, is vastly under-reported and poorly understood. Paradoxically, this configuring work is the most demanding and critical in the shaping of modern organisations. We suggest that this type of largely invisible work requires engagement beyond the level of execution or even the meaning of work, it requires intervening with third order effects that get to the core of what an organisation is. We highlight the challenges for organisations in dealing with third order change, particularly because these effects are beyond existing frames of reference and require more dynamic and supple responses based on the values, purpose and intent dominant in the organisation – we describe this as *structural digital work*. Leaders that are unable or unwilling to engage with effects at this level, and this type of work, will miss identifying core opportunities and risks associated with digital transformation in organisations. We also reflect on the value of current theories and methods used to research this important and emergent phenomenon.

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Introduction

In this special issue, we publish original research on strategic perspectives on the future of work and the digital transformation of modern organisations. Our call for papers (Baptista et al., 2017a) invited submission of academic studies investigating the adoption of workplace technologies in organisations with an emphasis on implications for strategy and the nature of organising. Suggested topics in the call for papers included, understanding the effects of workplace technologies on new dynamics and patterns of work, new structures and ways of organising, new capabilities and work practices, emerging leadership styles, and places and spaces of work with an outlook into the future of organising. We also hoped to use this effort to question the usefulness of extant theories and methods to study the deeper effects of digital workplace technologies on organisations, aiming to contributing with new concepts and theories that better reflect and respond to the emergent dynamics of digital work in modern organisations.

We are delighted to introduce four papers that form the basis of this special issue.[1] In this introduction, we discuss the significance of these papers and provide a broad view and conceptual foundation for studying the future of work in modern organisations. Since we accepted the papers, organisations and the world of work have been pushed further towards digital forms of organising in response to COVID-19-related restrictions. This has made the ideas in this special issue even more significant and relevant. We hope that this special issue offers both a meaningful framework for future research on digital work, but also more clarity on the effects of the shift towards digital working in organisations during and after the current crisis.

Each of the four papers provides a distinct but complementary viewpoint on digital work and emergent dynamics in the workplace. In no particular order, the paper by Morton et al. captures the introduction of a new digital platform to support strategy work and conceptualises the emergence of new work by senior leaders, and the structures needed to integrate more voices in strategic activity in the organisation. The paper by Rahrovani captures the effort required by community leaders to stabilise and create a convergence of logics of meaning in a digital platform after expanding and opening it up to new members. The paper by Grønsund and Aanestad reveals the work involved in the gradual and deep integration of advanced algorithmic analysis of open data feeds into strategic business processes and organisational structures. The authors reflect on the impact on individual roles, skills and group capabilities as the organization learnt to control, contextualize and complement automatically generated data. The paper by Rossi et al. shows employees crafting workspaces by assembling various digital workplace systems needed to do their day to day work. The paper then conceptualises this effort to create both flexible and stable structures to support the work.

Review of these four papers reveals how deeply embedded workplace technologies have become within organisations, while also showing how this process creates new types of work and influences the emergence of new structures and capabilities in organisations in response to the evolving nature of these technologies. While early research on digital workplace technologies such as email and intranets, captured the immediate and surface-level effects of these technologies (Damsgaard and Scheepers, 2000; Cecez-Kecmanovic et al., 1999; Bansler et al., 2000; Markus, 1994; Lee, 1994; Butler, 2003), what we observe now is the introduction of more advanced workplace technologies in organisations, while older technologies are becoming increasingly embedded in the fabric of organisations. The evolutionary use of workplace technologies in organisations over the last two decades has hybridised their use with human activities in organisations, forming complex (Benbya et al., 2020) and emergent human-in-the-loop (Rai et al., 2019) or meta-human configurations as new forms of socio-technical systems not seen before (Lyytinen et al., 2020). This provides researchers with a challenge to capture the deep effects of workplace technologies in organisations (Silva and Hirschheim, 2007) and emergent human-technology configurations (Suchman, 2012) so we can understand their strategic significance to organisations, leadership and business (Dery et al., 2017; Heavey et al., Tavakoli et al., 2017).

In this introduction, we conceptualise both the surface and deeper effects of workplace technologies on the patterns and nature of work and the structure of organisations, and relate them to the emergence of new types of configurations between humans and technology (Suchman, 2012). From this conceptual perspective, we then analyse the four papers in this special issue to demonstrate the relevance and value of these ideas and concepts. Our discussion then provides research directions and we reflect on the value of previous theories to explain the emergent dynamic and mutual shaping effects of workplace technologies on modern organisations. Ultimately, we hope to indicate a pathway to develop more relevant theoretical approaches to study the deep effects of advanced technologies to support work in organisations.

Digital work and workplace technologies: Evolution in modern organisations

Workplace technologies have evolved from basic discrete office applications to connected digital platforms (Leonardi et al., 2013) with elements of automation and embedded AI-driven self-learning capabilities in today's digital workplaces (Lyytinen et al., 2020; Faraj et al., 2018). This evolution in scope (Martini et al., 2009), complexity and depth of integration into the fabric of organisations is not well understood. Further, workplace technologies have largely been neglected and underrepresented in academic research in favour of greater attention to business and enterprise systems. However, while the impact of enterprise systems stems from their interplay with business models, the disruptive effects of workplace technologies on the nature of work and dynamics of organising

[1] A few words about the Special Issue process: The call for papers was published in issue no. 26 of JSIS in 2017. Interested authors could meet with the editors at the Changing Nature of Work (CNoW) workshop in Seoul at ICIS 2017. Deadline for submissions was March 2018, with 38 full submissions. In the first round, 17 papers were reviewed. We selected 8 papers to go into the second round of revisions. The final round of revisions included 4 papers, which were accepted in April 2020. We are grateful to the authors and reviewers of all the papers submitted. A special thank you to Robert Galliers and Guy Gable for their guidance, support and constructive feedback on this article and throughout this process.

(Baptista et al., 2017b, Stein et al., 2013) arise from the co-evolution of these technologies interplaying with the social fabric of organisations (Baptista, 2009; Clarke and Preece, 2005). We look back at the evolution of workplace technologies to offer a conceptual basis for understanding their evolving significance in organisations.

Broadly speaking, workplace technologies refer to a range of digital services that enable work within organisations. These range from office applications to integrated SMAC (social, mobile, analytics and cloud) technologies and smart sensing technologies using enterprise of things, smart agents, workplace robots, and self-learning algorithms (Attaran et al., 2020). We see a gradual layering of progressively more complex workplace technologies within organisations (Kane, 2017), from early workplace technologies based on individual office applications (Individual tools layer) to email, intranets, collaboration platforms and social media (Group and community layer) and, more recently, to advanced workplace technologies that add sensing devices, AI and cognitive knowledge and collaboration systems, robotic process automation and integrated digital platforms of work (Intelligent augmentation layer).

Research in this area has captured the nature and affordances of workplace technologies (Vaast and Kaganer, 2013; Treem and Leonardi, 2012; Leonardi and Vaast, 2016) but most of this research takes an instrumental view of these technologies by linking features of workplace technologies with more immediate behaviours and practices that contribute to performance, connectedness, knowledge sharing and collective action (Rice et al., 2017; Sæbø et al., 2020; Majchrzak et al., 2013; Kuegler et al., 2015; Von Krogh, 2012). Academic research is only recently starting to appreciate the deeper effects on organisations associated with these technologies (Riemer et al., 2015; Majchrzak et al., 2016; Spagnoletti et al., 2015; Aral et al., 2013; Hutter et al., 2017; Baptista et al., 2010), and taking the first steps to study the distinct nature of a new generation of workplace technologies based on self-determining platforms with artificial intelligence (AI) that can dynamically anticipate and respond to the needs and intentions of workers (Schuetz and Venkatesh, 2020; Lyytinen et al., 2020). The emerging complex human and machine collaborations (Benbya et al., 2020; Rai et al., 2019) move the role and nature of workplace technologies beyond merely having an instrumental and supporting role to humans in organisations (Riemer and Peters, 2020). Of course, standalone software applications are still being used for discrete and well defined processes and activities at the local level, such as spreadsheets for inventory management, but it is the way these individual applications become homogenised within a largely automated data-driven "information continents" (Lee, 2016a, Lamb and Davidson, 2005) that transforms work, blurring the lines between the performativity of users and the performativity of technology (Watson-Manheim and Klein, 2019).

This highlights the importance of describing and qualifying the distinct nature of these evolving layers of workplace technologies so that we become aware of emerging effects associated with more advanced workplace technologies in organisations (Raza et al., 2019). While earlier workplace technologies were instrumental in support of discrete office tasks of individuals, the advent of email, intranets and social media, connected workers to form communities demanding effort to manage conversations and interactions at the social and meaning level (Gibbs et al., 2013). More recently, we have seen the introduction of sophisticated algorithmic features and AI capabilities that leverage information and the features of individual and social workplace technologies to establish patterns of use that aim to anticipate worker and organisational needs and connect people with knowledge, and in some cases perform management functions, raising the possibility of removing the human from the loop. Table 1 summarises the functions and characteristics of these three layers of workplace technologies and suggests expected effects on the type of work associated with each layer.

In some cases, work in organisations may be aided by multi-layered, evolving technologies, combining instrumental, collaborative and algorithmic features, e.g. in order to collectively work on documents or coordinate project contributions. In other cases,

Table 1
Layered progression of workplace technologies.

	Function	Distinct characteristics	Expected effects on work
Intelligent augmentation layer	Platforms integrating office applications with advanced social media features, and added sensing technologies to connect and leverage people, knowledge and learning capabilities using central automation and AI capabilities. Potential to replace or augment human work and anticipate needs for knowledge and interactions in projects and work activities in organisations.	Distributed and integrated modular applications used within intelligent platforms that identify patterns and learn from use, with the potential to produce results and evolve without user intervention. Partially self-determining and able to perform managerial roles.	New types of complex digital work emerge centred on refining the "intelligence" of automated services, demanding managerial insight and effort to meaningfully assemble new work within the core of organisations.
Group and community layer	Enterprise-wide technologies to connect employees and share information, knowledge exchange, collaboration, and support internal communication. This includes intranet, collaboration platforms and internal social networks and media, allowing for commenting and open feedback.	Support and enable internal open communication and collaboration and facilitate community building. They integrate in the social fabric of organisations, bringing open models of operating in organisations.	New types of digital work emerge centred on sharing information, and managing interactions and social connections, demanding greater effort to integrate individual work in the social fabric of the organisation.
Individual tools layer	Standalone applications to support individual office work and facilitate office tasks such as word processing, calculations on spreadsheets, presentation and publishing office applications, text-based emails.	Instrumental technologies that have specific roles and functions to support discrete office tasks. They are segregated by type and not integrated or connected.	New types of digital work emerge centred on completing tasks fast and effectively, demanding limited effort to combine this with existing processes and practices.

technologies may automate certain tasks to the extent that no human work is needed to perform those tasks, however in those cases, human work then shifts towards effort to integrate automated processes within activities in the organisation. We wanted to interrogate these complex effects to gain a deeper and clearer understanding of how workplace technologies are changing organisational work, whose work is being changed, and the potential for this to disrupt established structures in organisations.

To observe and conceptualise these complex effects, we need to go beyond the direct and first-order effects, and consider second-, and third-order effects of change (Bartunek and Moch, 1987). As new types of digital workplace technologies have evolved from supporting functional tasks towards becoming embedded in organisational discourse and meaning, they have impacted on core aspects of the organisation and how it does business. They have also come to play a heightened role in organisational transformation (Vial, 2019) and in the rewiring of the organisation at deeper levels – this is considered next.

Digital transformation of organisations: Three orders of effects

Drawing on Bartunek and Moch (1987), we see first-order effects in the use of workplace technologies as effects that reinforce, enhance and evolve existing practices and understandings of work in organisations. First-order effects are therefore expected, intended and typically incremental effects of workplace technology use that do not change the overarching organisational systems already in place. We conceptualise first-order effects as *convergent change* (Tushman and Romanelli, 1985), that is, a change process occurring within a relatively stable structure, such as when an organisation improves its efficiency and effectiveness without rethinking its core processes (Besson and Rowe, 2012 p. 104).

Second-order effects are the result of the first-order effects that shift organisational schemata and social dynamics, and modify patterns of work and interactions. These unintended and typically unexpected effects trigger modifications in the organisational schemata, that is, the organising frameworks that guide cognitions, interpretations and actions of organisational actors (Bartunek and Moch, 1987 p. 484). Thus, we conceptualise second-order effects as *transforming work* where the established ways of thinking and acting are profoundly changing, but still within a given structure. This may happen, for example, when organisations adopt social media and other workplace technologies to stimulate a shift from efficiency-oriented work to innovation-oriented work but do so within their existing business operating model.

Third-order effects occur in reaction to second-order effects. These are effects outside the scope of existing operating reference systems that emerge from the evolving organisational capacity to manage second-order effects and the resultant change in organisational schemata (Bartunek and Moch, 1987). Third-order effects represent the emergence of entirely new schemata, reshaping views about the nature of work and how it is done, and the corresponding organisational structures. By organisational structures, we refer to the fundamental values and governance structures of an organisation or its "deep structure" (Silva and Hirschheim, 2007). Thus, we conceptualise third-order effects as *transforming the organisation* where the transformation in established ways of thinking and working, over time constitutes a fundamental transformation in the structure of organisations (Besson and Rowe, 2012); this conceptualisation echoes how recent research defines digital transformation as the (re)defining of the value proposition and identity of an organisation (Wessel et al., in press).

The progressive nature of these effects means that we can only observe "effects of effects" over time because of the gradual and incremental sedimentation and hybridisation inherent in the process of mutual shaping between technology and human activities in organisations (Baptista, 2009). It is also becoming apparent that workplace technologies in the intelligent augmentation layer can have deeper and more profound second- and third-order effects because they touch and intervene in the core schemata and structures of organisations, reframing perspectives and shifting established human-technology configurations (Suchman, 2012, 2007), rather than reinforcing established frames of reference and configurations, which would be a first-order effect.

Emergent human-technology configurations are central to understanding the progressive nature of the first-, second- and third-order effects of workplace technologies in organisations. Suchman conceptualises these configurations (2012, 2007) as *"how humans and machines are figured together – or configured – in contemporary technological discourses and practices, and how they might be reconfigured, or figured together differently"* (Suchman, 2012 p.49). Whilst first-order effects involve rudimentary configurations of human activity and digital technology, second- and third-order effects involve digital and human configurations of much greater complexity and scale, because they dynamically respond to the first-order effects. Third-order effects involve changes of a greater magnitude, scale and depth. They reflect work and technology change that reconfigures established human-technology configurations, so they involve organisational transformation beyond improvements to the execution of tasks.

Drawing on the established notion of human-technology configurations (Suchman, 2012, 2007), we propose that the layered evolution of workplace technologies and their progressively more transformational effects demand a slight shift in thinking and terminology. We suggest instead the use of the term "Digital/Human configurations". This continues to recognize the relational association between the human and the technology and emphasises the effort and "work" involved in managing these configurations. Explaining the notion of "configuration" Suchman (2012 p.49) places great emphasis on the "figuring it out together" or "figuration" saying *"To figure is to assign shape, designate what is to be made noticeable and consequential, to be taken as identifying"*. Human intervention is therefore at the centre of configuration, but as described above, this effort has evolved in nature (from task execution to managing interactions, to refinement of automated work) and can for many workers become more demanding, less satisfying and, seemingly, less effectual (Riemer and Peters, 2020) as the configurations become more complex and layered. We put Digital first in Digital/Human configurations to denote the emergence of new human digital work to manage these configurations where digital has an unprecedented role while human effort and endeavour is even more critical. Further, we indicate the blurring of the lines between the performativity of humans and the performativity of technology (Watson-Manheim and Klein, 2019) by replacing the hyphen with a forward slash. Table 2 summarises the three orders of effects of digital transformation.

Table 2
Defining first-, second-, and third-order effects of digital transformation.

First-order effects: *convergent change*	Second-order effects: *transforming work*	Third-order effects: *transforming the organisation*
Appropriation of layered workplace technologies creates expected and immediate organisational change to improve established patterns of work and enhance current ways of working.	Appropriation of layered workplace technologies creates unintended and unexpected changes in patterns and nature of work, leading to fundamental changes in organisational schemata observed only in hindsight.	Appropriation of layered workplace technologies and the first- and second-order effects create new understandings in the nature of work and shifts in the deep structure of organisations.
Effects: immediate effects on organisational processes and activities changing the execution of tasks, involving more basic Digital/Human configurations. Effort is necessary at the level of task execution to integrate new configurations with existing ones (effort that deals with questions such as "what is the task and how can we do it better?").	*Effects:* more complex Digital/Human configurations emerge, stimulating new ways of thinking about the nature of work, with impacts on the meaning of work but within an existing frame of reference. Effort is necessary at the level of meaning to "figure out" new configurations with existing ones (effort that deals with questions such as "what is work?").	*Effects:* emergent Digital/Human configurations challenge the deep structure of organisations, affecting the core of "what" an organisation is. Effort is necessary at deeper levels of intentionality and purpose of the organisation to stabilise new configurations with existing ones (effort that deals with questions such as "what is the organisation?").

This perspective highlights that existing research has perhaps been overly focused on capturing affordances and properties of digital tools entering the workplace, and thus focused on first-order effects of these technologies in organisations. Meanwhile, we have been underestimating the second- and third-order effects and the work involved in managing emergent Digital/Human configurations. This may be partially because these deeper effects are only now becoming more visible but also perhaps because our existing theories and methods have limited ability and scope to capture third-order effects (Benbya et al., 2020). We need theories that better recognise the hybridising and mutual shaping between digital and human aspects of work within organisations to study digital transformation; this need is recognised in the recent call for papers for a Special Issue of JAIS on "Advancing Theoretical Perspectives on Digital Transformation" (Markus and Rowe, 2020). These new theories need to be bold about agency in the doing of the digital work. With advanced workplace technologies, elements of platforms can be configured and assembled by humans to then have self-learning capabilities creating self-contained modules that perform tasks and operate independently, only requiring limited input from humans to manage exceptions (Schuetz and Venkatesh, 2020). At the same time, human agency increasingly moves from task execution to the sharpening and integration of emergent automated routines in the organisation, such as deciding on variables to be monitored, interpreting what variables mean, looking for biases in results, and training the AI. Accordingly, theories should allow for more flexible arrangements of agency in these advanced digital workplace platforms.

Above, we offered our two-fold conceptual perspective for understanding digital work and organisational transformation. First, we highlighted the different layers of evolving workplace technologies that are expected to fulfil increasingly sophisticated functions in organisations: from instrumental to collaborative to intelligent augmentation. Second, we suggested that the layers of evolving workplace technologies can have both surface and deeper effects on all types of workers, patterns of work, and the deep structure of organisations. These effects involve the emergence of ever more complex Digital/Human configurations and new work to manage these configurations. We now demonstrate the usefulness of this conceptual foundation by analysing the studies covered in the four papers in this special issue.

Special issue papers: Analysis of effects and emerging Digital/Human configurations

We use the concepts previously developed to analyse the papers in this special issue and capture insights on digital work and the effects of digital transformation on the future of organising. We review the papers by identifying the three orders of effects (convergent change, work transformation and organisational transformation) and the emerging Digital/Human configurations in each empirical study. We then reflect on the work involved in managing the emerging Digital/Human configurations in the next section. Table 3 summarises our review of these four studies, with an extended vision of possible third-order effects based on our framework.

As summarised in Table 3, the four papers in this special issue provide insight into the emergence of Digital/Human configurations and the three orders of effects of digital transformation resulting from the mutual shaping between organisations and workplace technologies. In the next section, we explore implications of this for organisations and future research.

Implications and future research directions

We now discuss three key implications for research and practice of our analysis of the four papers. We suggest future research to look into this newly emerging Digital/Human configuration work, from three different but interrelated perspectives: characterising, recognising, and envisioning. First, inherent characteristics of Digital/Human configuration need to be identified, studied, and refined as a basis for understanding this phenomenon in organisations. Second, we stress the need to recognise Digital/Human configuration work within the organisation in order to collectively improve configurations that work fairly and effectively. Third, we highlight the need to continuously envision Digital/Human configuration as part of the structural digital work necessary to guide the development of these emergent new assemblages in organisations.

Table 3
Papers in the special issue: Analysis of effects and Digital/Human configurations.

First-order effects: *convergent change*	Second-order effects: *transforming work*	Third-order effects: *transforming the organisation*
Morton et al.: *The Digital Work of Strategists: Using Open Strategy for Organisational Transformation*		
Leaders of a large association use social tools to engage directly with members on the development of a new strategy. Leaders share the strategy document and create a dedicated hashtag on Twitter, along with more traditional technologies such as shared files that allow commenting. This study shows that managing the new digital media involved managing feedback and integrating feedback in strategic planning in the organisation.	Continuous use of social media creates new practices by leaders to manage strategy. Four new types of strategizing work emerge: broadcasting, soliciting, collaborating, actioning. These new modes of strategizing imply new dynamics for managing strategy in the organisation.	Association follows a path towards open strategy and a "culture of dialogue" (Morton et al., p. 19) based on ongoing conversations and collaboration with the members. Significant management work emerges, related to "identity work", to encourage and frame the use of social media as part of this move towards open strategy.
*Digital/Human configurations: S*ocial media features are used to capture ideas from members to change strategy.	*Digital/Human configurations:* New governance processes to moderate and follow feedback and integrate it into processes of strategic planning and development in the organisation.	*Digital/Human configurations:* Social media becomes integrated within the culture and strategy of the association with the intended objective to signal that members own and are able to shape strategy.*Digital/Human configurations:* Social media becomes integrated within the culture and strategy of the association with the intended objective to signal that members own and are able to shape strategy.
Convergent change: Strategy includes contributions from members and is seen as more open and shared.	***Transforming work:*** Leaders create structures to manage inclusion and transparency in strategy.	***Transforming the organisation:*** The association gradually becomes seen as more inclusive and transparent.
Rahrovani: *Platform Drifting: When Work Digitalization Hijacks Its Spirit*		
A new community platform is created to mobilize and grow community membership in line with the community's values. Social media supports community work that used to be done by leaders in closed meetings. This links members to encourage participation and greater inclusion.	Social media changes what is seen as critical community work, changing the role of leaders as well as the role of members and volunteers. Adoption of the platform creates three types of new digital work: strategy work (positioning social media); infrastructure work (redesigning governance and policies); and aligning work (aligning the different logics of community).	Participation and inclusiveness become integral to the association supported by more advanced features of the platform and the growing community to include outsiders of the original group. The participative nature of the platform gradually drifts the original logic of cohesion towards a logic of inclusion, leading to rethinking the nature and identity of the community.
Digital/Human configurations: Social media features become part of the process to manage the growing community.	*Digital/Human configurations:* The open and participatory nature of the platforms becomes integral to the culture and functioning of the community.	*Digital/Human configurations:* The features of the platform influence and become deeply embedded in the emerging inclusive nature of the community.*Digital/Human configurations:* The features of the platform influence and become deeply embedded in the emerging inclusive nature of the community.
Convergent change: The community grows with greater participation and engagement.	***Transforming work:*** Community work is less centralised and becomes more distributed and participatory.	***Transforming the organisation:*** The association evolves from a position of cohesion to a position of inclusivity, shifting considerably the nature and identity of the community.
Grønsund & Aanestad: Augmenting the algorithm: emerging human-in-the-loop work configurations		
Algorithmic data analysis is used to process open real-time data to provide additional market insights and foresight to clients. The company develops their own algorithms to gain these capabilities and retain market position against new high technology competitors.	The existing work of the researcher is automated to a significant extent, but new work emerges to interpret and refine the algorithms and clean data. This includes auditing results against manually created 'ground truth' (contextualizing work), adjusting and altering the algorithm, data acquisition and data cleansing.	The algorithm becomes an entity with its own properties and status, and has a team working around it to control and enhance it, requiring new processes, roles, capabilities and culture. This is changing the organisational and business model to compete differently in new open data markets.
Digital/Human configurations: Automation of domain expert (researcher) tasks to improve speed and accuracy in sorting and synthesizing data into a trade-table, and integration of results in business processes.	*Digital/Human configurations:* Developing and using the algorithm required assembling teams differently and new roles to manage data and interpret results, including a data scientist.	*Digital/Human configurations:* Algorithms become integral to the functioning and strategic direction of the business and organisation. It is now a strategic asset for the business and integral to the market positioning of the organisation.
Convergent change: Algorithmic processing and analysis of data automates the researcher's work of creating trade-tables.	***Transforming work:*** Researcher work is automated and the work to produce trade-tables at the core of the company is now focused on data cleaning and refining the algorithm.	***Transforming the organisation:*** There is a new vision of what the organisation's core capabilities and valences are, centred around the new algorithmic capabilities.

(*continued on next page*)

Table 3 (*continued*)

First-order effects: *convergent change*	Second-order effects: *transforming work*	Third-order effects: *transforming the organisation*
Rossi et al.: *Balancing fluid and cemented routines in a digital workplace*		
A new automated process to select staff for projects is 'cemented' to reduce reliance on employees and make the process more efficient. This new process is meant to support managers that need to quickly staff projects. The system is embedded in the company's larger ERP environment. *Digital/Human configurations:* Project managers use the automated ERP staff module to find new people to staff the projects, speeding this process and reducing human effort involved. ***Convergent change****:* ERP-based workflow automates the staffing process in the organisation.	Project managers find that they need to use additional channels to improve the automated staffing ERP-based system. This involves considerable effort to interpret the results and find ways to combine other modules to produce a more useful result for them. *Digital/Human configurations:* Employees appropriate ERP features as well as technologies outside the ERP, such as social media and other collaborative tools, to create new workspaces that compensate for restriction of the automated ERP system. ***Transforming work****:* New work is necessary to compensate for the limitations of the automated system in finding best local candidates while also realizing corporate strategic goals.	Continuous operation of the automated system and workarounds means that the organisation develops dynamic balancing of enacted routines to create both stability and fluidity in this process. *Digital/Human configurations:* Automated staffing processes only work with added services and discretion in combining these services by the project manager. ***Transforming the organisation****:* Automation eliminates tasks but adds more effort by project managers. Organisation becomes capable of adopting automated services with a degree of flexibility and discretion.
Emergent themes across the four papers		
All four papers describe the use of workplace technologies to facilitate or enhance existing forms of work in the organisations. The technologies seem to be fairly effective in moving organisations forward, such as improving participation or task optimization. However, the use of new technologies also requires effort to integrate new technologies in established practices, resulting in **intensification of existing work:** open strategizing is more demanding than traditional strategizing; growing communities on social media requires more community work; automated algorithms require oversight; and the automation of staffing processes requires corrections.	All cases show that the intensification of work then produces unexpected new forms of work. For example, the work to manage communities leads to very difficult conversations about the nature of the community and its culture, as well as very significant governance work to regulate participation and growth of communities. This is also seen in work to integrate algorithms and automated services in organisations, which demand considerable effort to modify and integrate these systems in established work routines. We therefore see **digital work design** as one of the main characteristics of this order of effect.	The effects of changes in work design means that organisations adapt and modify core capabilities and structures and eventually shift the nature of their identity, culture and strategic position in markets. We see these changes across the papers, although this is more evident in some than in others. The kind of work emerging at this level is deep and structural, not anticipated and reactive. This is managerial work, although it is deeply rooted at the local level, and requires effort to understand first- and second-order effects and react to emergent changes. This new work is **structural digital work**, which is not often perceived or recognised but is visible when, for example, the logic of communities is influenced by digital media, or core capabilities of automation become prime business assets.

- *Implication and research direction #1: Characterising Digital/Human configuration work*

As seen, Digital/Human configurations are assembled arrangements between digital features and human intent and performative actions within organisations. Simple assemblages evolve to be increasingly complex configurations as new and more advanced technologies overlay simpler workplace technologies. These configurations emerge initially to enhance and augment work activities but effort to manage them grows more pronounced as they evolve to become more deeply woven into the activities of individuals and the fabric of organisations. This effort demands human ingenuity and innovation to generate, adapt and sustain productive and meaningful Digital/Human configurations within organisations.

Our perspective highlights the intensity of the human effort required to create and stabilise emergent Digital/Human configurations, and the work involved in maintaining these structures. As seen, individuals are critical in this context. Producing meaningful assemblages at the local level demands skilful effort to render features of these digital platforms in relation to local tasks and established structures in organisations. Crafting these configurations involves effort at the task level (e.g., making sure new tools are integrated into established practices or automated tools perform properly) and effort at the level of meaning and purpose of work and the organisation (e.g., strategic envisioning of new identity and capabilities).

Digital/Human configurations, therefore, involve effort to create incremental improvements in work at the local and individual levels, but also demand structural interventions deeply rooted in core properties of organisations such as identity, values and strategy (Stein et al., 2013). Configuration work at this level is often invisible and may not even be recognized by organisational actors as 'work'; they may, for example, perceive it instead as unsatisfying exception handling, or error detection in the reconciliation of accounts (Riemer and Peters, 2020). This suggests the need to better understand different kinds of configuration work within organisations, with future research addressing questions such as*: How to observe the emergence of Digital/Human configurations? Who is driving the configuration of digital and human aspects of organisations? What effort and skills are needed to manage evolving digital workplaces? How to surface and manage 'hidden' digital work to configure Digital/Human assemblages?*

Some of these questions challenge basic assumptions underlying existing theories and research on digital work design, including the well-known aegis of the joint optimization of the social and technical subsystems (Mumford, 2006), which requires these subsystems to be separated first, so that they can then both be specified and described. We need more dynamic and evolutionary theoretical views in order to properly understand Digital/Human configurations. We also need theories that are able to recognise the exponential effects of layered evolution of workplace technologies in organisations. For example, affordance theory, while capturing the relational aspect of configurations, may be too limiting and static in this context of ongoing evolutionary interplay between human agency and self-learning digital capabilities in modern workplaces. Despite strides against this shortcoming which we welcome (Strong et al., 2014), affordance theory isn't well equipped to capture long-term effects that are cumulative and uncertain and result from emergent practices. Affordances that emerge in third-order effects are not expected or visible in first-order effects.

- *Implication and research direction #2: Recognising Digital/Human configuration work*

The continuous assembling work involved in Digital/Human configurations ultimately leads to third-order effects of organisational transformation and therefore to changes in the understanding of work and shifts in the identity and strategic direction of organisations. This type of strategic configuration work is a new type of work that is often informal, so it is not recognised by organisations despite the significant implications for digital transformation. This type of effort is often invisible, overlooked and mismanaged by organisations, contributing to drift and potential increase in organisational risks. We therefore strongly suggest the need to pay more attention to this strategic configuration work by tracing how and who is managing and reorienting the rendering of workplace technologies within the fabric of organisations. For example, research is needed to capture whether, how and why strategic configuration work requires an entrepreneurial mindset that embraces failure (Ries, 2017), a desire to engage in job crafting (Wrzesniewski and Dutton, 2001) and perhaps even a kind of hacker mentality (Coleman, 2014), where destruction and creation go hand-in-hand. The role of the workplace equivalent of digital intrapreneurs will be important to consider for organisations looking to successfully manage the process of digital transformation.

As seen, strategic configuration work is deeply rooted in the fundamental structures of organisations, so observing this work requires attention to changes in the values, identity, power, core capabilities and strategy of the organisation. We therefore highlight the importance of managerial care and attention to this critical but often invisible configuration work, and the importance of adjusting leadership and management style and approach to be able to steer its effects in organisations. Future research could investigate: *How to anticipate, sensitise and steer second- and third-order effects of Digital/Human configurations? How can organisations adjust strategic capabilities to operate in more fluid digital work environments? What governance models allow for more effective appropriation of Digital/Human configurations? What is the role of leadership in managing evolving Digital/Human configurations?*

This calls for more holistic theories that capture and attribute strategic value to the process of blending of digital and human within organisations, so the asset is not the artefact or the human per se, but instead it is how organisation are able to meaningfully integrate the two. This needs better attention and to be seen as having strategic value. It goes beyond views and concepts of alignment and demands attention to second- and third-order effects as the actual strategic impact of this process. Having multi-level theories that see strategic leadership as the capacity needed to meaningfully and tactfully steer the process of Digital/Human configuration work is, therefore, of great importance.

- *Implication and research direction #3: Envisioning Digital/Human configuration work*

We have also seen that the widening use and adoption of workplace technologies with intelligent and self-contained capabilities is increasing instances where technologies generate work activities for humans in organisations, shifting the remit of these technologies from helping humans to also performing some limited managerial activities. In this context, digital tools produce work activities for humans, creating new and unique Digital/Human configurations, characterised by dynamics where technology uses humans rather than humans being users of the technology. Weaving these configurations within the wider organisation requires higher level management effort to adjust and meaningfully integrate these more advanced Digital/Human configurations within the organisation, by for example creating work and formal roles to monitor for misfit and repair when misfits lead to mistakes. Some of this work may be interesting, innovative and rewarding for humans (such as in analysing business intelligence output for identifying new strategic directions), but there is also less interesting work needed to train algorithms such as cleaning data and moderating content, work that has been described as unglamorous and underpaid 'ghost work' (Gray and Suri, 2019). Therefore, we should reflect on the design of the digital work of the future with an emphasis on the ethical distribution of work, responsibility and accountability in Digital/Human configurations (Gal et al., 2020).

Future research could, thus, address questions such as: *What is the human role in Digital/Human configurations? What is the quality (as opposed to quantity) of the work being created for humans? How can we avoid creating profoundly unequal tiers of digital work and combat workplace inequity?*

This type of envisioning, challenges existing IS theories because existing theories tend to favour explanation and description, and distance themselves from speculative and normative theorising. For example, sociomateriality and notions of entanglements lack the very long-term perspective needed for studying effects-of-effects, and often focus on the direct result of the social and the material coming together in a symbiotic entanglement, as if they evolved to optimise each other in a mutually benevolent way. The possibility of malevolent and parasitic entanglements is rarely considered. Forward-thinking, speculative theorising (Peter et al., 2020) may be one way to engage the IS field more widely in envisioning the future of work and organisations that humans will like and thrive in.

Conclusion and key contributions

Workplace technologies have evolved from basic discrete office applications in the 80s to the connected digital platforms with elements of automation and embedded AI-driven self-learning capabilities in today's digital workplaces (Lyytinen et al., 2020). This evolution in the scope and depth of integration of these workplace technologies into the fabric of organisations has transformed work but also the structure of organisations evolving from the use of these more advanced platforms of work. In this introduction to the special issue, we explore and conceptualise the *deep effects* of these human-technology configurations (Suchman, 2012) in transforming work practices (Stein et al., 2013) and the nature of work (Lee, 2016b) and ultimately the strategy and structural arrangements of organisations (Baptista et al., 2017b). We were particularly interested in observing effects that had the potential to fundamentally 'rewire' organisations and work environments (Watson-Manheim et al., 2002; Watson-Manheim and Belanger, 2007) and to explore the potential of workplace technologies to transform organisations such as by stimulating open participation (Hautz et al., 2017; Hautz, 2017; Denyer et al., 2011) or by being the catalyst for new organisational capabilities (Huang et al., 2013, 2015; Baptista and Galliers, 2012).

This introduction first conceptualises genres and types of workplace technologies and then analyses the layered evolution of these progressively more advanced and interconnected technologies in the workplace. We describe the nature and distinct characteristics of the individual layer of office tools, and the characteristics of the second layer of community and collaborative workplace technologies. We then discuss the more recent introduction of intelligent platform-based workplace technologies and discuss the distinct and unique dynamics involved in the configuring of these technologies within organisations.

We use this conceptual foundation to make an explicit link between these types of work technologies and organisational transformation and offer a richer and more comprehensive view of the role and effects of workplace technologies in organisations. We suggest that previous research has over-emphasised an instrumental view of these technologies by focusing on their capacity to enable virtual work and teamwork, communication and collaboration. We then conceptualise three orders of effects of workplace technologies on organisations based on Bartunek and Moch (1987). First-order effects represent convergent change, the expected and direct effects of workplace technologies on the performance of work. Second-order effects affects the roles and the nature of work in organisations. Third-order effects involve deeper transformation of the organisation and result in structural changes to the core elements of the organisation, such as its identity, capabilities and strategy. We provide a conceptual basis to structure the effects of workplace technologies at these three levels of change.

We suggest that this process of transformation involves the emergence of Digital/Human configurations, reflecting the assembling of digital features with human intent and their performative within organisations. We highlight that simple configurations evolve to be increasingly complex as new and more advanced technologies overlay simpler workplace technologies. Correspondingly, as configurations become more complex the effort required to manage them grows more pronounced, however much of this needed effort remains invisible and mismanaged in organisations. More research is needed on the kinds of organisational actors best placed to do this work, the skills they need and how to productively engage with the unpredictable effects of new technologies and the emerging Digital/Human configurations. We also highlight the importance of normative and speculative envisioning of future Digital/Human configurations if the IS field is to contribute to the creation of a future of work and organisations worth wanting.

We sincerely hope that these considerations are useful not only to guide future research but also to help organisations navigate a path towards digitisation beyond the COVID-19 crisis. As discussed, any move towards deeper adoption of workplace technologies will inevitably involve work to configure Digital/Human assemblages; organisations that properly resource this process are more likely to benefit and adjust to the "new normal" which we hope allows society to rethink work and organising for the benefit of all of us.

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