Accounting as a discipline has had a fraught relationship with technology – each generation of new technology has been written about in enthusiastic terms, only to be followed by disillusionment and abandonment some years later. It is the contention of this thesis that our current conceptualisation of the role of information technology in accounting, where the technological and the social are understood to be two separate and distinct entities, is inadequate in addressing the sociomaterial nature of technology, and consequently we are unable to grasp the ways in which technology is made to work in practice.

New technologies in organisations do not produce change in a straightforward, predictable manner. Instead, technology and organisational processes intertwine in complex patterns, leading to the emergence of novel practices and sometimes unforeseen outcomes. This thesis studies the mundane, material aspect of work from a sociomaterial perspective, in order to better understand the intricate, involuted intertwining between technology and accounting. It is a first step toward understanding the practical work involved in making technology work, and in turn making way for more grounded expectations of the effects of technology on accounting.
Intricate Involuted Intertwinings
On Accounting, Technology, and Materiality

Yu Xiang

Academic dissertation for the Degree of Doctor of Philosophy in Business Administration at Stockholm University to be publicly defended on Friday 15 December 2023 at 10.00 in Lärosal 22, hus 4, Albano, Albanovägen 12.

Abstract
The Information Age was supposed to be different. It was supposed to transform every aspect of our lives, and accounting was going to be no exception. Yet, management accounting as an academic discipline has had a fraught relationship with technology – each generation of new information technology has been written about in enthusiastic terms, only to be followed by disillusionment and abandonment some years later. It is the contention of this thesis that our current conceptualisation of the role of information technology in management accounting, where the technological and the social are understood to be two fundamentally separate and distinct entities, is inadequate in addressing the sociomaterial nature of technology, and consequently we are unable to grasp the ways in which technology is made to work in practice. New technologies in organisations do not produce change in a straightforward, predictable manner. Instead, technology and organisational processes intertwine in complex patterns, leading to the emergence of novel practices and sometimes unforeseen outcomes.

This thesis studies the mundane, material aspect of work from a sociomaterial perspective, one that emphasises the nature of technology as inseparable entanglements between the social and the material, in order to better understand the intricate, involuted intertwining between technology and management accounting. The papers that make up this thesis draw from a variety of sociological writings, including those of Knorr Cetina, Deleuze, and Galloway & Thacker, and find that technology is not solely the domain of designers and purchasers of technological systems, but is rather continuous performed by rank and file users in mundane interactions with technological artefacts. Moreover, they show that management accounting practices have material grounds, that the variety of devices we encounter in accounting, be they a chart, an ERP system, or an online ranking mechanism, do not exist in the world as disembodied and abstract concepts, but have materiality to them, and that this materiality shapes practices, often in unforeseen ways. These findings are a first step toward understanding the practical, everyday work involved in making technology work, and in turn making way for more grounded expectations of the effects of technology on management accounting.

Keywords: accounting, management accounting, digitalisation, information technology, enterprise resource planning, platforms, sociomateriality.

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Stockholm Business School
Stockholm University, 106 91 Stockholm
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What do I do when my love is away?
Does it worry you to be alone?
How do I feel by the end of the day?
Are you sad because you're on your own?

No, I get by with a little help from my friends.

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List of papers

**Paper I.** Xiang, Y., 2018. Effecting Spatiotemporality – ERP and Accountability

**Paper II.** Xiang, Y., 2022. YouTube and the protocological control of platform organisations
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Abstract

The Information Age was supposed to be different. It was supposed to transform every aspect of our lives, and accounting was going to be no exception. Yet, management accounting as an academic discipline has had a fraught relationship with technology – each generation of new information technology has been written about in enthusiastic terms, only to be followed by disillusionment and abandonment some years later. It is the contention of this thesis that our current conceptualisation of the role of information technology in management accounting, where the technological and the social are understood to be two fundamentally separate and distinct entities, is inadequate in addressing the sociomaterial nature of technology, and consequently we are unable to grasp the ways in which technology is made to work in practice. New technologies in organisations do not produce change in a straightforward, predictable manner. Instead, technology and organisational processes intertwine in complex patterns, leading to the emergence of novel practices and sometimes unforeseen outcomes.

This thesis studies the mundane, material aspect of work from a sociomaterial perspective, one that emphasises the nature of technology as inseparable entanglements between the social and the material, in order to better understand the intricate, involuted intertwining between technology and management accounting. The papers that make up this thesis draw from a variety of sociological writings, including those of Knorr Cetina, Deleuze, and Galloway & Thacker, and find that technology is not solely the domain of designers and purchasers of technological systems, but is rather continuous performed by rank and file users in mundane interactions with technological artefacts. Moreover, they show that management accounting practices have material grounds, that the variety of devices we encounter in accounting, be they a chart, an ERP system, or an online ranking mechanism, do not exist in the world as disembodied and abstract concepts, but have materiality to them, and that this materiality shapes practices, often in unforeseen ways. These findings are a first step toward understanding the practical, everyday work involved in making
technology work, and in turn making way for more grounded expectations of the effects of technology on management accounting.
Informationsåldern skulle vara annorlunda. Den skulle omvandla alla aspekter av våra liv, och redovisning skulle inte bli något undantag. Ändå har ekonomistyrning som akademisk disciplin haft en problematisk relation till teknik - varje generation av ny informationsteknik har skrivits om i entusiastiska termer, bara för att följas av besvikelse och övergivande några år senare. Denna avhandlings argument är att vår nuvarande konceptualisering av informationsteknikens roll i ekonomistyrning, där det teknologiska och det sociala förstös som två fundamentalt separata och distinkta entiteter, är otillräckligt för att ta itu med teknikens sociomateriella natur, och följaktligen kan vi inte förstå de sätt på vilka tekniken faktiskt fungerar i praktiken. Nya teknologier i organisationer skapar inte förändring på ett enkelt, förutsägbart sätt. Istället sammanflätas teknik och organisatoriska processer i komplexa mönster, vilket leder till framväxten av nya praxis och ibland oförutsedda resultat.

Denna avhandling studerar den vardagliga, materiella aspekten av arbete från ett sociomateriellt perspektiv, ett som betonar teknologins natur som oskiljaktiga sammanvävningar mellan det sociala och det materiella, för att bättre förstå den invecklade, intrasslade sammanflätningen mellan teknik och ekonomistyrning. De artiklar som utgör denna avhandling hämtar från en mängd sociologiska skrifter, inklusive dem av Knorr Cetina, Deleuze, och Galloway & Thacker, och finner att teknik inte enbart är domänen för designer och köpare av teknologiska system, utan snarare kontinuerligt utförd av vanliga användare i vardagliga interaktioner med teknologiska artefakter. Dessutom visar de att ekonomistyrning har materiella grunder, att de olika styrningsanordningar, vare sig det är ett diagram, ett ERP-system eller en online rankningsmekanism, inte existerar i världen som kroppslösa och abstrakta begrepp, men har materialitet, och att denna materialitet formar praxis, ofta på oförutsedda sätt. Dessa resultat är ett första steg mot att förstå det praktiska, vardagliga arbetet som är inblandat i att få teknologi att fungera, och i sin tur banar väg för mer grundade förväntningar på teknikens effekter på ekonomistyrning.
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ACCOUNTING, TECHNOLOGY, AND MATERIALITY

1. Introduction

From oral cultures to the advent of the written text, accounting has always been intimately linked to technologies. In this sense, the imbrication between technology and accounting is nothing new; indeed, accounting itself has often been referred to as a technology. At the same time, there is now a general sense that something profoundly different has happened since 1947, when John Bardeen, Walter Brattain, and William Shockley developed the first point-contact transistor – the world had entered the Information Age, nothing was to be the same, and accounting was going to be no exception. Like so many other fields, information technology was going to transform accounting. Yet, something peculiar has been taking place in management accounting research ever since. As Chapman (2005) and Scott & Wagner (2003) put it succinctly – each generation of new information technology has been written about in enthusiastic terms, only to be followed by disillusionment and abandonment some years later.

How could this be? It is the contention of this thesis that our current conceptualisation of the role of information technology in management accounting, where the technological and the social are understood to be two fundamentally separate and distinct entities, is inadequate in addressing the sociomaterial nature of technology, and consequently we are unable to grasp the ways in which technology is made to work in practice. This bifurcation between the technological and the social is in part cognitive and linguistic. To put it simply, whatever we might subscribe to theoretically, we tend as a practical matter to think of objects as being separate from humans. Moreover, numerous scholars of technology (e.g. Leonardi, 2013; Mutch, 2013; Barad, 2007; Suchman, 2007, to name just a few) have commented on the practical difficulties in conceptualising and writing about artefacts and human actors in terms that privilege neither.

At the same time, it is important to recognise that this divide between the social world of human actors and the material world of technology is also deeply political. Spence & Carter (2011) and Harney (2005) argue that management and organisation studies in general have had difficulties in adapting to the post-Fordist economy, where language, culture, communities, and affects are increasingly replacing the production of physical goods as the main source of value creation. In management accounting specifically, this manifests as a tendency to reify and make into “objects” or “things” that which capital can completely control, own, and sell, by stripping away from it those inherently human or social elements (Spence & Carter, 2011). Kittler (2013),
for example, argues that a software (e.g. an ERP system) is not a “thing,” but is rather performed – it is fundamentally a configuring of the hardware, nanoscopic switches made of silicon, carried out by communities of software engineers. A search engine is not a “object,” but a series of software codes (that are in themselves merely reified hardware configurations), created and maintained by programmers, executed on computer systems (that are in themselves a mangle of software and hardware), whose functionalities in turn rely on the countless individuals who continuously create and update web pages, as well as the vast number of users inputting search queries, day and night (Orlikowski, 2007). Technology is made into “things” in order that they can be owned and sold through an intellectual property framework (Galloway, 2012; Spence & Carter, 2011).

A necessary corollary of this then is that the implementation of a technology within an organisation is often viewed as transplanting a ready-made, commodified construct from a decontextualised and unlocatable site of production, to an equally decontextualised and unlocatable site of use. This conceptualisation is deeply political, precisely in that it depoliticises the process of technology production on the one hand, while on the other hand it effaces the work performed by rank and file users of technology in their everyday working life, a perspective implicitly tied to capital as the purchasers-but-not-end-users of commodified technology (Dillard & Yuthas, 2006; Suchman, 2002).

The cycles of grand promises, disappointments and moving on that are found in studies of technology in management accounting can be attributed to this simplistic, bifurcated understanding. New technologies in organisations do not produce change in a straightforward, predictable manner. Instead, technology and organisational processes intertwine in complex patterns, leading to the emergence of novel practices and sometimes unforeseen outcomes. Technologies are not synonymous with technological objects or artefacts, nor are they designs from nowhere, solely the works of anonymous and unlocatable designers, but are rather performed continuously by a variety of actors, including designers and users, in mundane, day-to-day interactions (Suchman, 2002). By appreciating the intricacies and interdependencies inherent in technological systems, we might pave the way for more realistic expectations, deeper understandings, and more fruitful examinations of technologies at work.

Sociomateriality as a conceptual position emphasises the intertwined nature of the social and the material in understanding technologies. Rather than viewing the social and the technological as distinct entities, sociomateriality posits that they are inseparably entangled,
co-constituting each other in the course of everyday practices. It explores the interplay between social practices and technological artefacts in organisations, and reveals that technologies are not merely passive tools, but actively influence and are influenced by organisational dynamics, values, and structures. This perspective also underscores the unpredictable nature of technological integration and its implications for organisations and society at large. It emphasises the often-overlooked material aspect of work, reminding us that organisational life is always embedded in a dense network of material artefacts, from laptops to software interfaces, which actively participate in the constitution of organisational realities.

The overall aim of this thesis is to study this mundane, material aspect of work from a sociomaterial perspective, in order to better understand the intricate, involuted intertwining between technology and management accounting, between the material and the social. It is a first step toward understanding the practical, everyday work involved in making technology work, and in turn making way for more grounded expectations of the effects of technology on management accounting. To this end, I pose two questions to be answered in the course of this thesis, 1) “how is technology performed in organisations and wider society?”, and 2) “what form does management accounting practices take in our present Information Age?”

Along this vein, this introductory chapter is a reading of the three papers that makes up the thesis, grounded in sociomateriality, performed in light of the current state of research on the relationship between technology and management accounting. While the papers that make up this thesis seldom invoke the notion of sociomateriality explicitly, I will nevertheless argue that the papers could be read as sociomaterial, insofar as they foreground the relationality, performativity, and the non-essentialist nature of technology. In doing so, I will also highlight the contribution each paper makes to our understanding of the relationship between technology and management accounting.

This introductory chapter will proceed thusly: firstly, using a framework described by Orlikowski (2010), I will provide an overview of the ways in which technology has been discussed in management accounting literature, and their implications for our understanding of technology. Secondly, I will introduce the concept of sociomateriality in greater detail and argue for its potential to contribute to management accounting studies. This is followed by a section discussing the theoretical and methodological implications of a sociomaterial approach to research, particularly in relation to the three articles in this thesis. I will then briefly present the three articles that form this thesis. The introductory chapter will then close with a brief
discussion on the potential contributions of the three papers specifically, and sociomateriality in general. The introductory chapter will then be followed by the three articles that make up this thesis.

2. The role of technology in management accounting research

Orlikowski (2010) identifies three distinct conceptual positions on technology within management and organisational studies in general, which are, as will be shown, also broadly applicable to management accounting research. Firstly, in what she characterises as the absent presence, technology as such is essentially unacknowledged and unaccounted for in management and organisational literature. While this stance dominated early management studies, it is in no way extinct. Orlikowski (2010) suggests that such an absence can be attributed to the fact that management and organisation studies have predominately been carried out by scholars whose background was in social or behavioural sciences. It is thus perhaps unsurprising that in these studies, ontological priority is given to human actors and social structures – organisation as a practice is conceived as fundamentally interpersonal in nature, while material conditions for organising are relegated to the background.

2.1 Technology as exogenous forces

Starting in the 1950s, a number of studies in management research began to conceptualise technology as an exogenous force, that is to say as material determinants of human behaviours and organisational characteristics, with significant, measurable, and predictable impacts on organisational outcomes (Orlikowski, 2010). Many of these studies took the form of contingency studies that attempted to theorise generalisable relationships between technology and organisation, where technology is the independent variable, operationalised in terms of various proxy measures (Orlikowski, 2010). Technology is assumed to be autonomous, homogenous, stable and predictable over time, rather than dynamic, embedded in social and historical contexts, and shaped by human agency (Orlikowski, 2010). Here, ontological priority is given to technological artefacts – material configurations generate predictable human and organisational outcomes.

Gordon & Miller’s 1976 treatise on the design of accounting information systems (AIS), published in Accounting, Organizations and Society, is typical of this conceptual position in the field of accounting. As in the earliest writings on AIS, the authors conceptualise accounting information systems as computerised systems for the collection, storage, and processing of financial and non-financial data, and as a powerful aid to effective organisational decision-
making. Whereas earlier writings on AIS sought to discover the single most desirable system design, Gordon & Miller’s (1976) contribution lies in highlighting the contingent nature of decision-making, and in arguing that accounting information system design ought to take into consideration the unique circumstances of specific organisations.

To this end, Gordon & Miller (1976) conceptualise accounting information systems as describable in terms of a number of characteristics, namely information load, degree of centralisation of reporting, cost allocation methods, frequency, timing, and method of reporting, types of information (e.g. financial/non-financial, internal/external, etc.), and valuation methods. The optimal accounting information system for any given organisation is thus one in which each of these characteristics is adapted to the specific environmental and organisational contexts, as well as the decision-making styles of the organisation, in order to enable effective decision-making (Gordon & Miller, 1976).

Furthermore, Gordon & Miller (1976) propose a number of hypotheses on the relationship between environmental, organisational, and decision-making variables, and system design characteristics of an effective accounting system, so that, for example, “[we] hypothesize that, as [environmental] hostility increases, the effective A.I.S. […] provides more frequent reports to inform managers of impending dangers” (p. 61), or “if managerial expertise is known to be deficient in any area, the accounting system can be used to provide data which could better inform managers about things they otherwise would not have been able to fully understand” (p. 63).

What can Gordon & Miller (1976) tell us about the relationship between technology and accounting? For one, the basic assumption here is that technology, in this case computerised accounting information systems, has predictable and detectable effects on individual and organisational behaviours, in terms of decision-making. To be sure, the influences that technology has on individuals and organisations are not deterministic, but are rather moderated by various contingency factors, but nevertheless the basic assumption is that such effects can be observed in order to generate generalisable knowledge.

Gordon & Miller’s (1976) focus on the contingent nature of accounting information systems is representative of early writings on technology in management accounting research. Other studies of this type included, for example, Gordon & Narayanan (1984), Chenhall & Morris (1986), and Gul & Chia (1994), all based on structured interviews/questionnaires. All to some
extent empirically studied the impact of organisational structures and environmental uncertainties on the perceived usefulness of accounting information systems, to name just three influential examples. Informed by the then recent advances in cognitive science, Driver & Mock (1975) examined the correlations between the individual’s decision-making style and information preference through experiments. Finally, combining cognitive and design sciences, Mauldin & Ruchala (1999) proposed a meta-theoretical, contingency-based framework for the study of accounting information systems, in which the focus is no longer on decision-making as such, but rather management accounting tasks in general, and the effects of contingency factors such as cognitive style, system design, and organisational structure on task performance.

As we enter the 1990s, the same conceptual position started to be applied to the study of the implementation and use of enterprise resource planning (ERP) systems and their relationships with management accounting. Perhaps because the ERP systems market is increasingly dominated by ready-made product packages from a few large vendors (e.g. Granlund & Malmi, 2002), ERP research has focused less on the question of system design, while more attention is paid to the factors affecting implementation, as well the effects such systems have had on management accounting tasks and the role of the management accountant. Thus, for example, Granlund & Malmi (2002) and Sangster et al (2009) both find that the introduction of ERP systems has freed management accountants from rote accounting tasks, to become more business-focused. Meanwhile, the effect of ERP systems on management accounting practices within organisations is far more limited (Rom & Rohde, 2006). Granlund & Malmi (2002) and Hyvönen (2003) both find that ERP implementation has had no significant effect on management accounting techniques within organisations, while a small-scale study by Spathis & Constantinides (2004) finds a slight increase in the use of non-financial performance measures in organisations with successfully implemented ERP systems.

It is important to note here that although Orlikowski (2010) observes that the conceptual position of technology-as-an-exogenous-force is often associated with variance logic and contingency research, it does not by any means preclude other types of research methodologies. As Cecez-Kecmanovic (2014) and Vosselman & De Loo (2023) note, the position need not be a methodological one, but one that is grounded in the fundamental understanding of technology as an external and relatively autonomous driver of individual and organisational behaviours, with predictable and generalisable effects. Thus, for example, Hyvönen (2003), Spathis & Constantinides (2004) and Sangster et al (2009) all employ a survey method, while Granlund
& Malmi (2002) is a field study of ten companies. Granlund & Malmi (2002) is also rather interesting, in that although the authors set out to conduct the study using institutional theory, they nevertheless conclude during the course of the study that the relative minor impact of ERP implementation has on management accounting practices can be more plausibly explained from the functionalist perspective, in terms of system complexity, cost of implementation, and problems encountered when attempting to interface different discrete systems within the same organisation.

As Orlikowski (2010) notes, there is a tendency, as the decades wore on, to speak of technology in increasingly non-physical and abstract terms. To be sure, a number of early studies of accounting information systems, published in mainstream accounting journals, directly address the technological nature of such systems, and its relation to accounting as a practice. For example, starting in the late 1960s a number of papers have attempted to address, from a data science perspective, the database management problems posed by double-entry bookkeeping (e.g. Colantoni et al, 1971; Lieberman & Whinston, 1975; Haseman & Whinston, 1976; Everest & Weber, 1977; McCarthy, 1982; all published within *The Accounting Review*); Mathews (1967) goes as far as to address the specific challenges faced by punched card and punched tape-based systems.

But as computing and data storage technology matured over the decades, these kinds of papers largely disappeared from the mainstream, and became confined to the niche of accounting information system literature. Instead, the notion of technology within management accounting studies became abstracted, with technologies often being described solely in term of their terminal effects, be it on decision-making (e.g. Gordon & Miller, 1976) or accounting tasks (e.g. Granlund & Malmi, 2002). A state of bifurcation prevails – literature with an obvious interest in accounting-related technologies as such has relatively little to say regarding management accounting, while management accounting literature typically only shows a superficial interest in the underlying technology (Sutton, 1992; Mauldin & Ruchala, 1999; Granlund & Mouritsen, 2003).

The tendency toward general explanations and prediction is arguably both a strength and a weakness. On the one hand, the statistical empirical work entailed has generated valuable and relevant insights across a wide range of contexts. On the other hand, such an approach tends to overlook the highly context-specific nature of the use of technology, and gloss over the micro-level practices that make technology work in practice (Orlikowski, 2010). Moreover,
technologies themselves are often reified in this perspective, e.g., organisations are said to be engaged in e-commerce, or use enterprise resource planning systems, as if these were singular, whole objects, as opposed to highly complex and situation-dependent arrangements of artefacts and practices (Orlikowski, 2010).

Moreover, the conceptual position of technology as an exogenous force overlooks the socially embedded nature of technology, and with it the role of human agency in shaping technology. Users of technology in particular become passive in this conceptualisation, merely acted upon by larger forces, produced elsewhere. This reinforces a view of technology as ready-made designs from nowhere (Suchman, 2002). As Suchman (2002) and Dillard & Yuthas (2006) argue, this can be viewed as part of a larger, and highly ideological, trend in mainstream management and organisation studies that often adopt a top-down perspective on technology, as something that is selected and implemented by management, while simultaneously overlooking the work, largely performed by rank and file users, that makes technology “work”.

2.2 Technology as emergent processes
Partly in response to the exogenous force conceptualisation of technology, a number of scholars have posited technology as an emergent process, one that arises from interactions with human agency, as well as societal and historical forces (Orlikowski, 2010). Technological artefacts are not ready-made, but are socially defined and socially produced. Ontological priority is thereby once more returned to human agency, while technology becomes fundamentally social in nature, embedded in specific historical and cultural contexts:

Central to an emergent process perspective is the notion that understandings of technology are neither fixed nor universal, but that they emerge from situated and reciprocal processes of interpreting and interacting with particular artifacts over time (Orlikowski, 2010, p. 131).

Den Hertog & Wielinga (1992) were among the first to adopt such a conceptual position in management accounting literature, in an article tellingly titled Control Systems in Dissonance: the Computer as an Ink Blot. Using a case study method, the authors examined the implementation of computerised production control systems in five engineering workshops in the Dutch multinational corporation Philips. The workshops provided various engineering services to internal clients, including prototyping and toolmaking, and faced with internal and external pressures, the workshops implemented a computerised control system, which was
intended to improve throughput time and delivery reliability. While the system seemingly provided straightforward solutions to the challenges faced by shop floor staff, the results of the implementation varied widely. In some workshops, improvements were observed in one or more output parameters, while other parameters remained unchanged; in one case, output actually declined following the implementation of the system.

This discrepancy, den Hertog & Wielinga (1992) argue, is largely a consequence of the differences in (often informal) organisational structure, culture, as well as the power relationships between the workshops. In all five sites studied, there was a strong sense of workshop culture, informal routines, and worker democracy and self-governance. In four out of five cases, these caused the workshops to reject the system entirely, modify the system significantly or use the system only selectively in a manner that did not disrupt existing local practices. It is also these workshops that saw the least disruption in the implementation process. Conversely, the workshop that faced the most problems was the one where the managers had sufficient bureaucratic wherewithal to force through the implementation wholesale.

Whereas earlier studies saw information technology as largely autonomous, with predictable effects on organisations and people, albeit moderated by contextual factors, den Hertog & Wielinga (1992) argue that such a view is overly mechanical. In terms of system design, the information system and its hardware and software configurations are but one part of the equation; at least equally as important are local customisations and adaptions made to the system, as well as the ways in which the system is actually used by shop floor staff. The fit between information technology systems and any specific organisation, to borrow the language of contingency studies, is not so much a function of the hardware and software characteristics of particular systems, as it is of the ways in which the system was actually used in the organisation. In other words, the information system, its implementation process, and its actual use, are not three distinct phenomena that can be studied separately, but rather together influence the effect of the system on the organisation and its members. Moreover, inasmuch as the structure and culture of the organisation significantly affect the latter two elements, structure and culture to a large extent determine the effectiveness of the new control system in use (den Hertog & Wielinga, 1992).

Studying the implementation of the ERP system SAP at two multinational organisations from an actor-network perspective, Quattrone & Hopper (2005) arrive at a largely similar conclusion. Whereas earlier writings on ERP systems were largely dominated by the expectation that
computerised and networked management control systems would lead to a centralisation of power (e.g. Bloomfield & Coombs, 1992), either towards top management or middle managers (a decentralised centralisation, so to speak). Quattrone & Hopper (2005) find that the question of centralisation/decentralisation is not so much a function of the ERP system as such, as it is a consequence of the prior organisational arrangements at the organisations studied. In one case, a highly hierarchical Japanese multinational corporation, SAP was adapted locally to replicate existing structures within the organisation, with intricate systems of internal transactions and access control. Consequently, the company was able to effect conventional accounting control over the entire global organisation, collapsing physical distances. In the other case, an American multinational, the lack of shared rules and routines across the organisation meant that the very same system (SAP) not only did not lead to centralisation, but actually created multiple, geographically discontinuous loci of control, each able to initiate changes within the system as a whole, and consequently eroding the sense of control for managers. So yet again, the effect of technology proved to be not a function of the technology itself, but rather how it is adapted and used in practice.

Whereas den Hertog & Wielinga (1992) and Quattrone & Hopper (2005) explore the organisational contexts that embody values, histories, and backgrounds within which the systems are implemented and used, Dillard & Yuthas (2006) remind us that technologies are not themselves neutral, empty vessels. Previous studies have suggested that information technology in the form of accounting information systems has a stabilising effect on management accounting practices – the systems in themselves embody a set of practices, while the costly nature of the systems discourages drastic changes (e.g. Hedberg & Jönsson, 1978; Granlund & Malmi, 2002; Scapens & Jazayeri, 2003). Dillard & Yuthas (2006) go further still and argue that the design principles underlying modern information systems are highly ideological in nature. From a Habermasian perspective, ERP systems are not apolitical tools, implemented to solve practical problems. Rather, Dillard & Yuthas (2006) argue, the widespread adoption of ERP systems is motivated by a specific socio-political context, specifically the economic crisis of the 1990s, arising from the inherent contradictions of neoliberal capitalism. The systems themselves are not neutral, but were embedded deeply within an instrumental, technical, rationalist logic that ultimately serves the interest of management. Imposed by management on behalf of capital, rather than arising from the natural discursive interactions of communities of stakeholders, information systems represent not only
the stabilisation of existing management accounting practices, but also the reification of the technical-rationalist logic of the current economic system (Dilllard & Yuthas, 2006).

Besides highlighting the embedded logic of information systems, critical works such as Dillard & Yuthas (2006) also expand the scope of studies of technology in management accounting to include the wider socio-political implication of technology. This stream has gained particular relevance, as with the rise of the so-called platform economy, management technology and its embedded neoliberal logic began increasingly to diffuse into other, non-traditional settings (e.g. Van den Bussche & Dambrin, 2021; Chapman et al, 2021; McDaid et al, 2023; Wickramasinghe et al, 2023).

But even as scholarly works from this emergent process position provide a richer context of the social, economic, political, and historical context within which information technologies are deployed, and the processes, practices, values, and ideologies embedded within the technologies themselves, the role of technology as material presences with specific physical properties and affordances is minimised. Materiality thus becomes passive, largely or wholly subordinate to human interpretation and social actions (Barad, 2003). Indeed, Rom & Rohde (2006) said of this stream of research, it is as if “[actors] can make almost whatever they want of an ERP system” (p. 56). In this respect, human actors become the autonomous force, be they managers imposing ideologies in the workplace or shop floor staff resisting and defending established culture, routines, and practices. Technology is relegated to be the conduit through which human agencies flow and diffuse throughout organisations and society at large (Hultin, 2019).

Analytically, there is a propensity to reduce phenomena to representations of already-known abstract constructs, so that “an adequate account of any phenomenon […] is a formal theory that represents just those aspects of the phenomenon that are true regardless of particular circumstances” (Suchman, 2007, p. 176). Objects are, in turn, reduced in terms of their resemblance to other categories of objects, so that when one speaks of the implementation of a particular ERP system in a particular organisation, for example, one speaks as if the objects in question were ERP systems or organisations as generalised categories (Hultin, 2019). In the process, the particularities and situatedness of each encounter are rendered invisible (Suchman, 2007; Hultin, 2019).
2.3 Entanglement in action, or the sociomateriality of technology

The exogenous force and emergent process positions differ in their ontology, the former grants ontological priority to the material and the latter to the social. For the exogenous force position, the social and the material are separate and separable, while in the emergent process position the social and the material are intertwined and mutually constitutive. Yet to Orlikowski (2010), the two positions nevertheless share the core assumption of an ontological separation between the social and the material; the material and the social, or the technological and the human, are essentially different and distinguishable.

Both technology-as-exogenous-force and technology-as-emergent-process are grounded in what Emirbayer (1997) has described as a substantialist ontology, one that “takes as its point of departure the notion that it is substances of various kinds (things, beings, essences) that constitute the fundamental units of all inquiry. Systematic analysis is to begin with these self-subsistent entities, which come ‘preformed,’ and only then to consider the dynamic flows in which they subsequently involve themselves” (pp. 282-283). In this way, human actors and technological artefacts are distinct and self-contained, and although they might interact in various ways, their influence on each other is essentially one of moderating factors; they in no way change each other in essential ways (Latour, 1994; Emirbayer, 1997). Latour (1994) notes of this position, “the twin mistake of the materialists and the sociologists is to start with essence, those of subjects or those of objects” (p. 33). As will be shown, this is fundamentally different from a relational ontology, in which the objects and actors are constituted in dynamic, unfolding relationships with each other. And it is this ontological separation that underlies their respective weakness as theoretical conceptualisations of technology in organisations – by focusing on the material, one unavoidably overlooks the social, and vice versa (Orlikowski, 2007, 2010).

Orlikowski (2010) contends that recent developments in science and technology studies have given rise to a fourth conceptual position, that of entanglement in practice, or sociomateriality as it became better known, which relies on a relational ontology that privileges neither the human nor the technological, but rather sees the social and the material as fundamentally entangled and inseparable. Orlikowski’s (2010) own account of relational ontology is heavily influenced by Barad’s (2003; 2007) theory of agential realism. In agential realism, the basic ontological elements are not individual objects or actors with inherent boundaries and properties, but rather what Barad (2003) refers to as phenomena (p. 815), which she defines as “the ontological inseparability of agentially intra-acting ‘components’” (ibid.). The term “intra-
“action” is necessary because agential realism does not presuppose the prior existence of objects with distinct boundaries; hence the “components” are not truly a priori separate, and they do not interact with one another, as inter- implies being in between inherently separate entities. Phenomena are then the primitive entanglement of indeterminate matter in the world, “relations without preexisting relata” (ibid, p. 815).

While Barad does not deny the existence of matter prior to intra-action, matter remains without inherent boundaries and properties, and is thus analytically inert. Boundaries and properties are not inherent to phenomena, but are only manifest in relations. Boundaries are constituted in relation to that which is not within boundaries, and properties can only be meaningfully articulated in relation to other phenomena, e.g., having a similar or dissimilar colour to something else, or having twice or half the mass of something else. Boundaries and properties are contingent on the phenomenon’s relationship to an observing agency, and their indeterminacies are always resolved locally by the observing agency through a so-called *agential cut*, a specific intra-action between the observing agency and the phenomenon that materialises the world in a specific way. And the agential cut is enacted via some form of *apparatus*, which Barad defines as the “the specific material reconfigurings through which ‘objects’ and ‘subjects’ are produced” (2007, p. 148). Though Barad would no doubt dismiss such a characterisation as crude, apparatus in this sense can also be roughly understood as observational devices or laboratory instruments. Moreover, the agent and the apparatus are also themselves phenomena, in continuous intra-action within and without. Beings and objects do not exist as distinct entities prior to relations and through relations influence each other, but actors, both human and non-human, are fundamentally constituted in interactions (or rather, intra-actions), and perform continuously in relation to each other (Orlikowski & Scott, 2008).

As Slife (2004) succinctly puts it:

> Relationships are not just the interactions of what was originally nonrelational; relationships are relational “all the way down.” Things are not first self-contained entities and then interactive. Each thing, including each person, is first and always a nexus of relations…all things, including all practices, have a shared being and a mutual constitution in this sense. They start out and forever remain in relationship (p. 159).
Agency resides not in the human agent alone, but rather in the relation of intra-action between agent and the apparatus, both as phenomena (Barad, 2003; 2007). This creates a fundamental inseparability between ontology, epistemology and ethics – knowing is world-making, and the knower, however inextricably bound in relation to others, is accountable for the world brought forth (Barad, 2003; 2007).

An example from extant management accounting literature may be illustrative of sociomateriality as an applied research approach. Earlier research in accounting has highlighted the transformative role of rankings in economic life. Rankings and other evaluative devices produce a “mechanism of reactivity” that encourages market actors to adapt behaviours to conform to mechanisms of calculation (Espeland & Sauder, 2007). Yet as Pollock & D’Adderio (2012) suggest, this conceptualisation essentially suggests that rankings belong solely to the sphere of the social – rankings become a thing that actors do, the effects of which reside entirely in the “heads” of other actors. Miller & O’Leary (2007) argue that the power of numerical devices such as rankings resides in the fact that they represent interactions between programmes (“imagining and conceptualising,” p. 702) and technologies (“devices, instruments, calculations and inscription,” p. 702), which is to say that as well as being social, there is also an undeniably material dimension to rankings that is being overlooked by relegating such devices to the social.

It is this focus on the material that forms the basis of Pollock & D’Adderio’s (2012) examination of the construction and use of the Magic Quadrant, an influential set of rankings of the information technology industry produced by American consulting firm Gartner. In its most basic form, the Magic Quadrant is a two-by-two matrix that sorts technology vendors within a given market segment according to two dimensions. But instead of an abstract construct, the idea of a visualisation tool, so to speak, Pollock & D’Adderio (2012) discover that the Magic Quadrant manifests itself in the world as an object with physical properties. More specifically, whether displayed on a computer screen or printed on a sheet of paper, the Magic Quadrant has to be legible and comprehensible to humans, meaning that the number of dots, representing vendors, can be neither too tightly nor too sparsely placed. This materiality affects the work of analysts at Gartner, who often adjust inclusion criteria so that a given market segment contains 10 to 25 vendors, occupying different quadrants of the matrix, in order to present a “beautiful picture.” In this way, Pollock & D’Adderio (2012) demonstrate that devices such as the Magic Quadrant are not merely visual representations of abstract objects, i.e. a
ranking, whose effects on the world are entirely social, but are rather objects whose own material properties are shaped by and shape the social world.

With a more strictly sociomaterial reading of Pollock & D’Adderio (2012), it becomes apparent that the information technology at the heart of the Magic Quadrant is relational. There is no “market”, except as a description of sets of relations – relations between vendors and clients, between vendors and employees, between vendors and other vendors. Vendors, products, and client needs are diverse, and it is not self-evident that any two given vendors are within the same competitive space; nor are the boundaries between the constituents of the market and their respective properties inherent to them, but these only become manifest from the perspective of specific observers, in this case Gartner, as an influential technology consultancy firm.

In this sense then, the Magic Quadrant can be understood as the apparatus through which the “market” is produced, for the material affordances and constraints of the Quadrant set limits on the type of knowledge that can be produced – the market produced in this way cannot contain so many vendors as to make the Quadrant illegible, nor so few vendors as to obliterate the need for a Quadrant. The competitive spaces constituted in this way are products of intense back-and-forth between the observer and the Quadrant’s material properties. For example, the number of vendors claiming to offer social software has grown so rapidly that it can no longer be comprehensibly visualised in a single Quadrant, making it necessary for analysts to adjust the inclusion criteria, producing subsegments and sub-markets – “Social Software” thus becomes “Social Software for the Workplace,” “Externally Facing Social Software,” “Social CRM;” what was originally a single object, the market for Social Software, thereby becomes three (Pollock & D’Adderio, 2012, p. 580).

Moreover, both the observing agency and the apparatus are themselves in entanglement within and without. Gartner itself is not a monolith, but is composed of numerous actors within networks of relations. Each Magic Quadrant is the end product of a long bureaucratic process – a Quadrant is usually developed by a team of analysts, then undergoes peer review by other teams within the same subject area, before being further reviewed by a senior analyst. Quadrants are usually retired when they contain too few vendors to be meaningful, but are also zealously guarded and maintained by their respective teams; teams whose Quadrants are “old and dying” may develop new Quadrants to maintain their positions within the organisation. Gartner itself is also embedded in a for-profit economic system. The analysts interviewed hint
at the true reason why “old and dying” Quadrants are to be retired – rankings are seen as useful when there is a perceived complexity in the market; a market that contains a handful of actors is not deemed to be sufficiently complex to require Gartner’s services.

The case of the Magic Quadrant is also illustrative of the inseparability between ontology, epistemology, and ethics under a sociomaterial approach. Relations precede the object, but these relations are without definite boundaries and properties prior to being materialised by an observer. The “market” does not and cannot exist except as relations prior to being recorded, measured, calculated, and presented by analysts using the Magic Quadrant. But the “market” produced in this way is always contingent and local, continuously evolving due to social (the need to remain commercially relevant) and material (the Quadrant’s own material properties) forces. Agency resides not solely in the individual analysts, the teams, or the firm, but in the entanglement of the human and non-human actants. Simultaneously empowered and restrained by the material properties of the Magic Quadrant, the analysts are continuously compelled and enabled to adjust the criteria to produce a “beautiful picture,” to materialise different worlds, the material effects of which reverberate in the wider economy through mechanisms of reactivity.

To be sure, Pollock & D’Adderio (2012) do not invoke Barad, nor explicitly employ Baradian terminology, but the text is nevertheless illustrative of a sociomaterial approach to management accounting research (and, as will be explicated below, while Baradian agential realism is in significant ways foundational to sociomaterial thinking, it is by no means the only way to conduct sociomaterial research). To date, relatively few studies in management accounting have adopted an explicitly sociomaterial perspective. For example, Wagner et al’s (2011) study followed the introduction of a new ERP system at a university, using a sociomaterial conceptual model consisting of two constructs – “reconfiguration” and “relationality”. Wagner et al (2011) found that the constellation of hardware, software, and social practices that constitute an ERP system are continuously renegotiated in different ways (reconfiguration), subject to the forces of organisational politics within and between university departments (relationality). Scott & Orlikowski (2012) studied how accountability in the hospitality industry has been reconfigured by online rating and ranking mechanisms, and found that the idea of accountability is always inextricably entangled with material practices, that is to say, there is no “original” or untouched form of accountability that can be studied apart from some form of technology. In the case of online reviews and rankings, hoteliers, platform users, and the technology’s specific material
affordances (e.g. anonymous, one-sided, continuously updated, processed and filtered through algorithms) have together performed a form of accountability that is at once hierarchical, non-negotiable, and self-referential for hoteliers, and humanising and socialising for platform users, providing a way for users to “see travel in and through others” (Scott & Orlikowski, 2012, p. 37)

While not wishing to efface their contributions to the development of sociomaterial research approach in management accounting, one general criticism that may be levelled at extant sociomaterial research in management accounting is that, save for the explicit mentioning of sociomateriality, much of the current research is often otherwise indistinguishable from that deriving from the emergent process position. That is to say that the social often still takes precedence over the material. Take Wagner et al (2011) as an example – the ERP system at the centre of the case is almost entirely abstracted and without physicality; while the concept of relationality, so central to any sociomaterial approach, is operationalised as an entirely social process of negotiations between different groupings of human actors. On a broader level, this is also reflective of the general state of sociomateriality within management and organisation studies in general, where the extant literature is still very much “social” in nature, where the focus still remains on the interactions between human actors, and the materiality of technology is under-explored, (Cecez-Kecmanovic et al, 2014). This is perhaps in part due to the fact that management and organisational studies have traditionally employed scholars whose training is in social or behavioural sciences. At the same time, as will be explored later in the methods and methodology section of this introductory chapter, there are also methodological difficulties inherent in a sociomaterial approach (Mutch, 2013; Leonardi, 2013).

In terms of the approach of the papers in this thesis, the theoretical driving force has always been this apparent absence of materiality in much of the current research that is ostensibly focused on technological systems. As already stated, the overall aim of this thesis is to examine the mundane interactions between people and objects, in order to foreground the elaborate entanglements between accounting practices and technology. While not explicitly adopting a conceptualisation of sociomateriality based on Barad’s agential realism, as will be argued below, the theoretical choices of the papers nevertheless reflect a focus on the interactions between human agency and technological artefacts, and the material consequences of such entanglements on management accounting.
3. Sociomateriality

Sociomateriality, then, refers to a conceptual position on technology informed by such a relational ontology. Humans and technological artefacts are not discrete actors with essential properties and boundaries prior to interactions. It is rather the case that properties and boundaries are enacted through relationships between actors (Orlikowski, 2010; Cecez-Kecmanovic et al, 2014). Moreover, social practices such as management control do not exist independently and prior to technology, but are rather always enacted and disclosed through interactions between actors and technology. Technology is in turn not the tools used by human actors in their practices, but rather humans and non-humans enact practices through the entanglement (Cecez-Kecmanovic et al, 2014; Vosselman & De Loo, 2023).

While early works from a sociomaterial position leaned heavily on the work of Barad and Orlikowski, as Cecez-Kecmanovic et al (2014) note, sociomateriality has developed considerably since first proposed by Orlikowski & Scott (2008), sometimes in directions away from Baradian agential realism. Just as the conceptual positions of technology-as-exogenous-force and technology-as-emergent-process are not theoretical positions, but can contain any number of theories and methodologies that share the same basic outlook on the natures of technology, human, and organisations, neither is sociomateriality a theory as such, but it can include any number of theories of similar characteristics, of which Baradian agential realism is but one prominent example (Cecez-Kecmanovic et al, 2014; Vosselman & De Loo, 2023).

Taking a broader view, Cecez-Kecmanovic et al (2014) and Vosselman & De Loo (2023), among others, have called for a pluralist approach to sociomateriality that is open to theoretical explorations and experimentations. Cecez-Kecmanovic et al (2014) thus define sociomateriality as any material-semiotic approach to technology that is characterised by relationality, performativity, and a non-essentialist view of materiality (Cecez-Kecmanovic et al, 2014). In other words, any theoretical or methodological position can be considered to be sociomaterial if it takes the view that people and technology are without essential boundaries and properties, and that objects, whether social or material, are always iteratively performed through inter(intra-)actions. Moreover, as Cecez-Kecmanovic et al (2014) note, this definition is more a matter of Wittgensteinian family resemblance than strict dogma, and a variety of work in management studies in general, from a plethora of theoretical positions, could be seen as broadly sociomaterial in outlook. Vosselman & De Loo (2023) distinguish between strong sociomateriality and weak sociomateriality, with the former being strictly post-humanist and
locating agency in the entanglement of humans and technologies, while the latter still maintains some level of primacy of human agency in intra-actions. Wagner et al (2011), for example, focus almost exclusively on the agency of human actors in the implementation of an ERP system at a university, while still explicitly deploying sociomaterial concepts.

Actor network theory, with its relational ontology, its symmetrical treatment of human and non-human agencies, and its focus on the ways in which networks of actants are performed and stabilised, can be considered a strong form sociomateriality (Cecez-Kecmanovic et al, 2014; Vosselman & De Loo, 2023). Riemer & Johnson (2012) and Introna (2013) separately developed theories of technology, following Harman’s readings of Heidegger’s phenomenology of objects and the concept of Zuhandenheit (“readiness-to-hand”) (e.g. Harman, 2018). Both of these can be considered broadly sociomaterial in their decentring of human agency and focus on practical logic (Cecez-Kecmanovic et al, 2014).

Furthermore, Orlikowski (2007, 2010) has credited a number of theories as sources of inspiration for sociomateriality, and can be considered broadly sociomaterial in outlook (Cecez-Kecmanovic et al, 2014). This list includes Suchman (e.g. 2002, 2007) and her pioneering work in mapping the situated actions of users of technology, and the ways in which technology is continuously constructed and reconstructed through interactions with users. Knorr Cetina’s (1997) concept of object-centred sociality, which explores the relations between human actors and objects, the indeterminacy of “knowledge objects” and how such objects continuously unfold and evolve through interactions with human actors, resonates strongly with Barad’s notion of agential realism. Similarly, Pickering’s (2010) concept of mangle of practice, which focuses on the complex and dynamic interplay between human and non-human actors within specific social and material contexts, has also been used as the theoretical basis for sociomaterial studies (e.g. Venters et al, 2014). Practice theory too (e.g. Feldman & Orlikowski, 2011; Gherardi, 2012; Schatzki, 2002), which focuses on understanding human practices as the fundamental unit of analysis for social life and the construction of meaning, has served as a source of theoretical inspiration for sociomateriality. While Schatzki (2002) focuses practice as human actions, more recent work (e.g. Feldman & Orlikowski, 2011; Gherardi, 2012) has paid considerably more attention to objects and material arrangements, and their role in the production of social phenomena. Inasmuch as none of the above theories accept a symmetry between human and material agencies, they can be considered weaker forms of sociomateriality in Vosselman & De Loo’s (2023) typology.
3.1 The theoretical approach

In the light of the aforementioned spirit of theoretical pluralism and experimentation, the theoretical frameworks of the three papers that make up this thesis can be considered sociomaterial, specifically in terms of their emphases on relationality, performativity and non-essentialist view of materiality. The first paper, titled Effecting Spatiotemporality – ERP and Accountability, employs Knorr Cetina’s concepts of scopic systems and synthetic situation (Knorr Cetina, 2014, 2009; Knorr Cetina & Bruegger, 2002). A “scopic system” is any form of electronic, televised media in which textual or visual information is conveyed to multiple actors in a temporalised, continuous fashion (Knorr Cetina, 2014). Schutz (1964, cited in Knorr Cetina & Bruegger, 2002) argues that one of the simplest forms of sociality is a “we relation,” in which two physically co-present individuals simultaneously observe a common third object; even in the absence of verbal or non-verbal communication, a certain level of intersubjective understanding is achieved, as each individual recognises that the other must have been experiencing the unfolding of events in a manner not dissimilar to themselves. Drawing on this, Knorr Cetina & Bruegger (2002) argue that scopic media such as computer systems can play the role of the third object, thus enabling the formation of a “we relation” between temporally and spatially separated actors. Importantly, scopic systems differ from broadcast media in that communication through the system is interactive – responses from observers are propagated through the system to other observers, so that the temporal coordination between multiple observers is not merely assumed, but rather physical co-presence is partly or wholly replaced by “response presence,” that is to say the ability to respond to distant others through the system (Knorr Cetina & Bruegger, 2002).

A “synthetic situation”, then, is a form of social interaction that involves a scopic system, one that is with, through, or in the presence of electronically transmitted on-screen projections (Knorr Cetina, 2009, 2014). A trader monitoring and operating in a financial market through the screen of an electronic trading terminal is the archetypal synthetic situation, but so is a group of people using a video conferencing program, or a players interacting in an online computer game, or indeed two workers discussing the figures on an ERP system screen. A synthetic situation is inherently relational, inasmuch as it is constituted in the interactions between human actors and electronic screens. A synthetic situation is also performative – it is not a ready-made object that neutrally references some aspect of the world like a window, but is continuously made and remade through interactions with users (Knorr Cetina, 2009). And it remains ontologically fluid, as what is shown on the screens need not follow the spatial and
temporal orders of the real world, but is always transitory and provisional, contingent upon interactions (Knorr Cetina & Preda, 2007). In purely synthetic situations such as electronic trading, the projected reality of the scopic system is not independent of the actions of actors; at the moment of interaction, bits and pieces of data are pulled together, projected on the screens, and an intersubjective reality forms, which then rapidly unravels, as that reality is updated and replaced.

The second paper, YouTube and the Protocological Control Platform Organisations, makes use of Galloway & Thacker’s (2004, 2007) notion of the “protocol,” which denotes the inseparability between the technical and social constructs that facilitate interactions between interconnected-but-autonomous actors, and the ways in which these constructs shape interactions. The authors see protocol as a natural extension of power-knowledge in the digital age. Human actors are increasingly surveilled, reduced, quantified, and aggregated into “dividuals,” not distinct individuals with definite boundaries, but sets of calculable and combinable traces (e.g. demographics, geographical locations, browsing history) (Deleuze, 1992). This form of subjectivity in turn makes possible a form of rigid control in ostensibly open systems, where interactions are facilitated and shaped differentially. In this way, “dividuals” at location X, with interest Y, can be directed toward content Z when arriving on a platform, in a way not dissimilar to how subjects and objects are constituted through intra-action within Baradian agental realism.

Furthermore, protocols are relational, in that the protocol cannot be reduced to the technical and social constructs that facilitate interactions, but rather describes the ways in which these constructs are embedded, embodied, and enacted by actors in encounters with each other. Protocols govern interactions by facilitating them differentially, and their effects are probabilistic, not deterministic; some forms of interaction are technically possible, but statistically unlikely. Thus, for example, interactions between actors on the internet is facilitated and governed by a host of technical (e.g. Telnet, TCP, IP) and social (e.g. laws, rules, and etiquettes) protocols. These can be regarded as systems of protocols because they simultaneously make interactions possible and impose a certain kind of logic to said interactions.

The third paper, Design Without End – The Story of an Evaluation System, applies the concepts of “prosumption” (Ritzer & Jurgenson, 2010; Arvidsson, 2005) and “immaterial labour” (Lazzarato, 1996). While not explicitly sociomaterial in its theoretical approach, the empirical
focus is nevertheless on the materiality of an online review system, and how the variety of visual devices of the system such as lists, tables, charts, and graphs were steadily refined and evolved through the years, not solely at the discretion of the owner of the platform, but often in response to the unexpected and often unsanctioned ways in which they are used by the users. The review system thus becomes a site of production of immaterial labour, while demonstrating that classification and comparison mechanisms are not finished constructs, occasionally improved upon and updated for the “better”, but are always performed by a variety of actors, owners and users alike, in a dynamic process of, back-and-forth between.

4. Reflections on methodology and methods

The papers that make up this thesis primarily employ an ethnographic method. Paper 1 is based on some seventy observations, made over the course of one year; while papers 2 and 3, which focus on online platforms, adopt a “netnographical” approach, that is to say the adaption of ethnographic methods for the study of computer-mediated communication (Kozinets, 2002). As ethnography is also commonly employed across interpretative research in general, this warrants some comment. Surveying the state of sociomaterial research in management and organisation studies at the time, Cecez-Kecmanovic et al (2014) lamented that although research adopting this approach has made significant theoretical progress by demonstrating the entanglement of the social and the material realms, the majority of studies continued to employ the same methods as those from an interpretivist perspective, so much so that many studies would be virtually indistinguishable from interpretative research, save for the explicit mentioning of sociomateriality (see also, for example, Hultin, 2019).

Indeed, as Mutch (2013) and Leonardi (2013) argue, there are a number of practical difficulties associated with adopting sociomateriality, particularly one that is based on Barad’s agential realism, as an approach to empirical research. More specifically, in terms of empirical operationalisation, scholars must as a practical matter define the “material” constructs in their studies, at least implicitly (e.g. an “ERP system” or an “online platform”), which in turn decouples some aspects of the phenomenon being studied from its inherent sociomateriality (Leonardi, 2013). In strictly Baradian terms, by defining the “material” in an empirical setting, an agential cut is enacted which produces a reality distinct from the one which one set out to study. Moreover, as Leonardi (2013) notes, actors in the world are highly unlikely to view the material and the social, or the technological and the human, as being mutually constituted in entanglements. Actors typically react to the materiality of technology as if it is stable and
bounded, even as the materiality is transformed through interactions. While this in no way diminishes theoretical relevance of sociomateriality, it does necessarily imply that field research from a sociomaterial perspective does violence to the points-of-view of actors in the field (Leonardi, 2013).

Mutch (2013) and Leonardi (2013) therefore argue for a sociomaterial approach grounded in critical realism, not agential realism, where a separation the social and the material is enacted according to the actors’ experience, at least as a matter of methodological bracketing. It may be that the world is enacted through the intra-actions of phenomena, observing agencies, and apparatuses, but that as a practical matter, material agency is treated as structural properties, ones that predate the actions and interpretations of human actors; materiality exists independently of human actors, but affordances and constraints presented by materiality do not. The social and the material are analytically distinct at the outset, but become mangled, entangled, imbricated, interpenetrated and ultimately reconfigured in particular ways through situated actions (Leonardi, 2013).

At the same time, as Vosselman & De Loo (2023) and Cecez-Kecmanovic et al (2014) argue, a sociomaterial research approach to technology needs not to be tied to agential realism, and we should remain open to a variety of theoretical positions that take seriously the relational and performative nature of materiality. Indeed, in advocating theoretical pluralism within sociomateriality, Cecez-Kecmanovic et al (2014) argue for the possibility of sociomateriality grounded in critical realism rather than agential realism. As was hopefully made clear in the preceding section on the theoretical approaches of the papers in this thesis, this pluralism in sociomateriality is also the position of this thesis.

Hultin (2019) argues that sociomateriality as an approach is compatible with interpretivist methods such as interviews and observations, provided that the researcher foregrounds the performativity of sociomaterial practices. In practice, this means to engage with the boring and mundane, to direct attention to the experiences and memories of interaction with material artefacts, the ways in which the actors engage with the materiality of their surroundings, and the ways in which the materiality enacts the possibility of understanding, acting, and being. Reflecting on her own fieldwork when researching for Hultin & Introna (2018) at the Swedish Migration Board, she admits that her exploration began not with sociomateriality, but with an interest in the implementation of Lean at the agency and its effect on the everyday work of case officers. It was during the course of the implementation process that the unit being studied was
moved to a new building, and Hultin (2019) was struck by the physical layout of the new reception area, and the ways in which relationships between case workers and asylum applicants were reconfigured through entanglement with the new physical layout.

My own empirical journey has been somewhat similar, inasmuch as I too did not set out to study sociomateriality. Initially, my interest was in the relationship between causal reasoning and accountability. However, in the course of conducting research for my first paper, I became fascinated with the often central role played by the ERP system in day-to-day work at the site being studied. Munro (1996) asserts that material objects, what he refers to as intermediaries, are no mere “contexts”, lying outside the social world of accountability, but are rather deeply implicated in accountability relations, both in eliciting accounts and as an effect of giving and receiving accounts. And so began my interest in the role of interactions between human actors and artefacts in the production of everyday practices. In a sense, then, my own research interest in sociomateriality is a matter of entanglement. I did not intend to write from a sociomaterial position from the outset, yet was led to it through an interest in the mundane interactions between human actors and material artefacts, as well as theoretical choices that foregrounded the performativity of technology.

And it is this focus on the mundane interactions with technology that has guided the fieldwork underlying the three papers that make up this thesis. In the course of gathering material for the first paper, special attention was paid to the ways in which the actors reflected upon and talked about, in more or less formal settings, their use of the organisation’s ERP system; a significant amount of time was also spent standing next to members of the organisation as they performed routine tasks on the system. As papers 2 and 3 both focused on internet-based platforms, the first order of business was to become familiar with the platforms and their various interfaces. Secondly, I looked to the information made available by the platforms regarding its systems and algorithms. Thirdly, observations and commentaries regarding the materiality of the platforms were gathered on the respective platforms, as well as social media services and both popular and trade press. Analytically, the focus has been to identify the possibilities and impossibilities of acting and being created with the materiality of the computerised systems, and the ways in which the objects of enquiry, be they an ERP system or an online platform, are enacted in the everyday practice of the actors.
Paper 1 - Effecting Spatiotemporality – ERP and Accountability

Article 1 explores the use of modern information technology and its effect on our notion of accountability. Our present conceptualisation of accountability has its roots in social interactions, and ordinarily social interactions presume a shared physical space and physical copresence (Garfinkel, 1967; Goffman, 1983; Roberts, 1991; Knorr Cetina, 2009). If the interactions from which accountability arises are largely presumed to be local phenomena, what happens to accountability when this locality is destabilised through the use of information technology?

Quattrone & Hopper (2005) indicate that the use of information technology leads not necessarily to the diminishment of temporal and spatial distances between the controller and the controlled, as is often touted. In some cases, information technology actually enables widespread access to and control over accounting data, and leads to the creation of multiple, localised calculable spaces that were only loosely connected to one another spatially and temporally. Similarly, Scott & Orlikowski (2012) note that web-based, crowd-sourced services bring about novel reconfigurations of relations of accountability. The local context for socialising forms of accountability is no longer bound by easily-defined physical spaces, but is created when travellers encounter hoteliers, as well as each other, through information systems.

The focus of the paper is thus to examine information technology as the material basis of accountability (Scott & Orlikowski, 2012). Specifically, information technology is conceptualised in terms of Knorr Cetina’s (2014) notion of scopic systems, which, she argues, brings about novel configurations of space and time. The concept of scopic system implies the collection and simultaneous projection of information to a large audience and, in turn, actions or responses are mediated through the scopic system and propagated to all actors (Knorr Cetina & Preda, 2007). Relationships are neither stable nor can they be presupposed, but rather occur on an ad hoc basis by way of interactions through the system. This in turn ties into the idea that the reality as projected by scopic systems is always in flux. Knorr Cetina (2014) emphasises that the focus in the concept of synthetic situation ought to be on individuals’ interactions with and through the scopic systems, and not the infrastructural or relational networks, and thus this first paper conceptualises the enterprise resource planning system at a Scandinavian retailer as one such system, and focuses on the routine interactions with, through, and besides the ERP system.
The study finds that accountability at the organisation is impacted by the system’s ability to effect two separate, yet interrelated spatial-temporal orders, one “real” and physical, the other existing only in the ERP system. The spatial context for accountability, though occurring in the physical space, is in fact the point at which the two spatial-temporal orders are brought into contact, through interactions with, through, or besides the ERP system as scopic media; often, neither order has ontological precedence over the other. In this case, time too is often indeterminate – it is not absolute, but is rather only manifest in the changes in the states of the two systems. Much of the accountability work relating to the use of the ERP system consists of locating an event as seen in one spatial-temporal order in the other, and attempting to reconcile the two orders.

Paper 2 - YouTube and the Protocological Control Platform Organisations

Paper 2 focuses on controls on platforms, a form of organising made possible by modern information technologies. In this paper, platforms are defined as technical and social infrastructures on which actors may interact (Srnicek, 2017). Whether they are social media services such as Facebook or web-based marketplaces such as eBay, they share a key characteristic – they all rely in their value creation process on the media content, products, and services provided by external actors who may or may not have any direct economic relationship with the owners of the platform, and who may join the platform with very little in the way of vetting (Srnicek, 2017). Yet this ostensibly “open” nature does not render the concept of control irrelevant for platforms; indeed, as most platforms are operated by for-profit businesses, it is very much in the owners’ interest to control the nature of interactions on platforms (Kornberger et al, 2017; Srnicek, 2017). The question then is how controls are enacted in such organisations.

Based on a netnographic study of the recommendation system of the video-sharing platform YouTube, the paper employs Galloway & Thacker’s (2004) concept of the protocol as a way to conceptualise the digital and social infrastructures of YouTube as a form of control, one that not so much encloses users in governable spaces, but rather facilitates interactions between users differentially. The recommendation system does not so much concern itself with any universal criteria of “good” or “bad”, but rather seeks to create relationships between users and generate slices of digital reality through a system of decentralised of controls based on digital traces of interactions of individual users.

The study finds a novel form of control in the system of protocols and evaluative infrastructures on YouTube, one that shifts the focus away from the governable individuals, towards
“dividuals”, digitalised and aggregated traces of interactions. The system encourages the
generation of vast amounts of user content, then uses evaluative infrastructures to identify those
that are commercially viable, and then rapidly bootstraps their popularity in order to maximise
viewing time and advertising revenue. Users as definite individuals are not the real subjects of
such a form of control, but are rather only useful in terms of the digitalised traces left behind
by their interaction; the outcome of such a system thus becomes “statistically predictable but
individually unpredictable.”

Paper 3 - Design Without End – The Story of an Evaluation System
The focus on platforms is continued in Article 3, which examines the evolution of the user
review system on Steam, an online game distribution service, as a way to study the mutually
constitutive relationship between the material properties of the review system and the
calculative practices of actors on the platform. Accounting research has long had a fascination
with rankings, ratings, and other regimes of classification and comparison, an interest that has
only been heightened by the rise of internet-based services with user rating or review
functionalities. Scott & Orlikowski (2012) have stressed the importance of considering the role
of the material configurations of rating or review systems in shaping the practices of actors. In
this vein, rather than providing a snapshot in time, this paper traces the development and
evolution of one such system from its launch to the present day, in so doing creating a biography
of an algorithm (Glaser et al 2021), in order to highlight the back-and-forth process in which
the system has shaped and is in turn shaped by user interactions, and the inherent
sociomateriality of evaluation mechanisms.

To this end, the paper focuses on the evolution of the review system and its myriad of visual
devices, while employing the notion of the “prosumption” (Ritzer & Jurgenson, 2010;
Arvidsson, 2005), which highlights the intertwined nature of consumption and production in
the modern economy, as well as Lazzarato’s (1996) concept of immaterial labour, that is to say
the creation of the social context of production from the worker’s cognitive, social, and
affective competences. The paper argues that the Steam review system, with its variety of visual
devices such as lists, tables, charts, and graphs, is best understood as a site of prosumption,
where users are engaged in the production of immaterial labour. Empirically, the paper is built
on a netnographic study of the review system on Steam, using information gathered from the
platform’s official developer blog and user forums, as well as secondary sources in the form of
press coverage.
In the case of Steam, the paper finds that while the construction of the review system can be seen to have embodied the goals and intents of the platform operator at its launch and throughout its lifespan, the material configurations of the system intersected with diverse user intents to create a range of affordances that enabled a range interactions that were technically feasible, but ran counter to the intents of the operators. Rather than restricting user interactions, the platform operator instead addressed these challenges by adding additional visual devices, more affordances and more venues of exploitation, in order to capture the immaterial labour of users (Lazzarato, 1996). The paper thus shows that classification and comparison mechanisms are not finished constructs, occasionally improved upon and updated for the “better”, but are always the subject of a dynamic process of back-and-forth between its owners and different groups of users.

6. Discussion and conclusion

With all this said, what can a sociomaterial perspective tell us about the relationship between management accounting and technology? In order to answer this question, let us return to the two questions posed at the beginning of this chapter. In terms of the first question, that is to say that of how technology is performed in organisations and wider society, the papers in this thesis make it clear that technology is not solely the domain of designers and purchasers of technological systems. Rather, technology requires the work of rank and file users to work (Suchman, 2002). Take the first paper, for example; much of the invisible work involved in using the ERP system entails reconciling the two often contradictory spatio-temporal orders, to locate that which appears in the digital realm of the ERP system in the physical world, and vice versa. YouTube’s recommendation system too is fundamentally reliant on users, whose interactions are calculated and aggregated into digital traces. Likewise, the functioning of online platforms relies on the immaterial labour of lay users, who draw on some shared symbolic resource to create, however briefly, shared meaning, or a sense of community or belonging with other actors through their interactions on the platforms.

This insight is particularly relevant in our present time, when we are periodically inundated with narratives of the imminent redundancy of human labour. It is often said that unprecedented advances in artificial intelligence, machine learning and automation in general will transform the nature of work, resulting in ever-rising levels of “technological unemployment,” the societal consequences of which can only be addressed by radical reconfigurations of our current social arrangements (Brynjolfsson & McAfee, 2014, to name just one particularly influential...
More recently, this technocentric narrative of widespread technology-induced job destruction has become increasingly challenged by scholars, particularly those of a more critical persuasion. Benanav (2020), for example, argues that the discourse around automation and the elimination of human labour can be traced back to at least the time of the First Industrial Revolution, and that much of decline in demand for labour in the decades following World War II can be better explained by the contraction of global manufacturing capacity through corporate consolidation and globalisation, rather than purely in terms of productivity increases through technology. Benanav (2020) is quick to point out that just because predictions of widespread job destruction have been wrong in the past, it does not necessarily imply that such a prediction will always be incorrect.

Yet it is tempting to ask what has led to this recurring discourse around technology and automation. To Benanav (2020), one of the fundamental difficulties involved in making any reliable predictions on the relationship between technology and the future of work is that of differentiating between labour-substituting and labour-augmenting technologies, where the former substitutes human labour entirely, while latter “merely” augments the productive capacity of workers. Suchman’s (2002) example of the work of litigation support workers at large law firm typifies this difficulty. Litigation support workers at the firm were tasked with processing the thousands of documents involved in each legal case and encoding the documents into searchable, computerised databases, to be used by the litigation teams. These workers occupied the lowest rank of the organisational hierarchy, and their work was often described by attorneys as “mindless” and “routine,” ripe for automation. Yet through her investigations, Suchman (2002) was surprised to discover that far from merely “encoding,” the work of litigation support involved a significant degree of interpretation and judgement, tasks that could not have been automated given the technologies of the time.

Ultimately, the problem of differentiating between labour-substituting and labour-augmenting technologies touches on the question of the fundamental nature of a given type of work. What is it that we do in our work? Does a shop floor employee “merely” stack shelves, operate the cash register, or answer simple questions? Or does she also form a crucial link in a powerful-yet-imperfect ERP system? When we say that her job can be automated, how certain can we be in our prediction, when in truth we know so little about the nature of her work?

As for our second question, that of the form of management accounting practices in the age of information technology. Firstly, we may conclude that accounting practices have material
grounds. This is to say that the variety of devices we encounter in accounting, be they a chart, an ERP system, or an online ranking mechanism, do not exist in the world as disembodied and abstract concepts, but have materiality to them, and that this materiality shapes practices, often in unforeseen ways. Take the example of the ERP system in the first paper: the system is continuously updated (though not necessarily in real time) and broadcast simultaneously to a variety of actors. The consequence of this is that two separate, yet interrelated spatial-temporal orders are enacted, one of them “real”, while the other exists only in the “virtual” world of the ERP system. One may argue that this is nothing new, in that it is analogous to the notion of action-at-distance, but manifested in a digital age (Robson, 1992). Yet at the same time, it is useful to be reminded that this spatiotemporality is a consequence not of “accounting” itself, whatever that might be, but is rather contingent on the affordances of the specific technologies involved, for as Vosselman & De Loo (2023) argue, there is not an object form of accounting prior to technology, but rather the practice of accounting is always entangled in intra-action with various forms of technology, be they writing, numbers or computerised ERP systems.

Secondly, this material ground for accounting is not synonymous with technological artefacts or objects, but is itself rather an entanglement of human and material agencies. For example, as the second and third papers demonstrate, ranking devices cannot be reduced to either the physical infrastructure of interconnected computers or the software that runs on them, but are rather made up of an entanglement of hardware, software and human agencies. The binary between the controller and the controlled is an artificial one, and the latter is always implicated to some extent in any regime of control (Ahrens & Mollona, 2007). If technology is the entanglement between human and material agencies, then the functioning of technology will always depend to some extent on the ways in which technology is understood by rank and file users of technology. And, as the papers have shown, this enactment of technology is not a stable one, but is rather continuously evolving, often in directions unforeseen by the owners of the technical infrastructure.

Furthermore, this erodes our conventional understandings of organisational boundaries, in that the users who perform and enact technologies are often not members of the organisation as such, but outside others who have been enabled to interact with technological systems in various ways. As it has been hopefully made clear in papers 2 and 3, the materiality of internet platforms is part and parcel of systems of user control. Yet even in the case of the retailer in paper 1, one might rightly ask just how much the retail customer is integrated into systems of
control, for after all, the entire inventory of the company is quite literally at their fingertips. To what extent can they said to be performing control when they make an inventory enquiry? Or are they also the subjects of control when inventory status directs them to a particular location?

Thirdly, the papers in this thesis hint at the potential for deeper integration of knowledge and insights from various fields of design studies into management and organisation studies. Suchman’s (2007) ground-breaking work is not only noted for its importance to the field of sociology in general and sociomateriality in particular, but is also a foundational text in the field of human-computer interaction. Likewise, many later sociomaterial studies in management and organisation studies have touched on elements of design; for example, it could be said that Hultin & Introna (2019) is as much about the impact of interior architecture as it is about organisation studies. In a similar vein, various studies in accounting have explored the power of the visual in effecting calculative practices (e.g. Puyou & Quattrone, 2018; Chakhovich & McGoun, 2016; Pollock & D’Adderio, 2012). As we enter the digital age, and we increasingly carry out interactions with, alongside, and through technological artefacts, it seems obvious to me that fields such as human-computer interaction and user experience design have much to contribute to our understanding of organisational phenomena in general and management accounting in particular.

In conclusion, this thesis demonstrates that a sociomaterial research approach can contribute to our understanding of technology and management accounting in three ways. Firstly, by foregrounding the performative nature of technology, sociomateriality materialises accounting. Accounting is and has always been embedded in dense networks of material artefacts. These artefacts are no mere “contexts,” lying outside the social world of accountability, but are always part and parcel of the practice that we call accounting. And this performative materiality has tangible consequences for practice, as they form, in Barad’s (2007) words, “the material conditions of possibility and impossibility of mattering” (p. 148) – the ability of accounting ability to construct reality is enabled and constrained by the material means through which we measure, quantify, calculate, and visualise. Secondly, by highlighting the performative nature of technology, sociomateriality historicises technology. Technology is not synonymous with stable, ready-made artefacts, but is rather always situated and contingent; it is performed on site. And the same applies to accounting devices and practices, be they tables, charts, graphs, ERP systems or online rankings. Accounting devices have histories and are deeply embedded in the economic and social contexts of the times of their creation. Lastly, by emphasising the
performative nature of technology, sociomateriality politicises accounting. Technologies are not designs from nowhere, but are always confluences of politics, whether on the part of designers, owners or users. Inasmuch as accounting and information technology are becoming increasingly intertwined, it becomes more important than ever to examine the role of technology as the conduit of politics.
7. References


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