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Beyond Interpretivism? New Encounters with Technology and Organization

IFIP WG 8.2 Working Conference
on Information Systems and Organizations, IS&O 2016
Dublin, Ireland, December 9–10, 2016
Proceedings

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The flagship event is the IFIP World Computer Congress, at which both invited and contributed papers are presented. Contributed papers are rigorously refereed and the rejection rate is high.

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Preface

The papers in this volume constitute the proceedings of a working conference organized by the IFIP Working Group 8.2 whose brief is "The Interaction of Information Systems and the Organization." The conference, entitled "Beyond Interpretivism? New Encounters with Technology and Organization," was held during December from 9–10 at University College Dublin, Ireland.

The Call for Papers resulted in a total of 75 submissions. Of these, 12 full papers, ten panel papers, and 24 poster papers were finally selected for presentation at the working conference. The submissions were selected through a blind review process involving two reviewers and the editors. Authors of submissions that were selected for the next round were requested to revise their contributions in accordance with the reviewers' and the editors' recommendations. The revised submissions were then reviewed for publication in this volume. An introductory paper by the editors provides a thematic overview of these papers.

The papers published in this volume are complemented by contributions from the two plenary speakers at the conference: an invited paper from Karin Knorr Cetina (University of Konstanz and the University of Chicago) and a conversation with Tim Ingold (University of Aberdeen) based on his published interviews.

Karin Knorr Cetina is the Otto Borchert Distinguished Service Professor and Chair of the Department of Sociology at the University of Chicago. Karin's research has made seminal contributions to the field of science and technology studies (STS). She has conducted major studies on the financial markets, knowledge and information, as well as in globalization, theory, and culture. Her current projects include a book on global foreign exchange markets and on post-social knowledge societies. She continues to do ground-breaking research on the information architecture of financial markets, on their "global microstructures" (the global, social, and cultural form these markets take) and on trader markets in contrast to producer markets. Karin has won numerous awards that acknowledge her original sociological thought including the John Desmond Bernal Prize from the Society for Social Studies of Science for her distinguished contribution.

Tim Ingold is Chair in Social Anthropology at the University of Aberdeen, having previously been the Max Gluckman Professor of Social Anthropology at the University of Manchester. In his recent work, he has sought to forge a distinctive approach to understanding the relation, in human social life and experience, between movement, knowledge, and description. This has inspired him to examine the use of lines in culture, and the relationship between anthropology, architecture, art, and design – conceived, in ecological terms, as ways of exploring the relations between human beings and the environments they inhabit. Tim continues to provide provocative, fresh insights into the world of social anthropology and is a pioneer in boundary-crossing within the social sciences. He was elected to a Fellowship of the British Academy in 1997 and of the Royal Society of Edinburgh in 2000.

The editors would like to take this opportunity to thank all the contributors to this volume. We are also very grateful to all the members of the Program Committee who participated in the review process. We would like to acknowledge the assistance provided by University College Dublin, and the support of Lancaster University (UK), Massachusetts Institute of Technology (USA), and the London School of Economics (UK). We thank Gemma Marren for her careful copy-editing of this volume, Bill Doolin, Kevin Crowston, Brian Fitzgerald, and Ulrike Schultze from IFIP WG 8.2 for their advice and support throughout the process, and Erika Siebert-Cole and her colleagues at Springer for their help in producing these proceedings. We give special thanks to Allen Higgins and Maura Mulvey for all their hard work on the conference organization. We would also like to thank the UCD College of Business and the Fáilte Ireland Conference Ambassador program for their support in hosting and sponsoring the conference.

October 2016

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Introduction

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The IFIP Working Group 8.2 has a distinguished history in shaping research agendas around information technology and organization. The 1984 Manchester Working Conference [1] has been long regarded as a key moment in the movement to embrace more pluralistic, post-positivist research approaches within the Information Systems (IS) field. Subsequent working conferences built on this by promoting and developing interpretive modes of enquiry into IS and organizational phenomena, thus shaping the formation of a generation of IS researchers. Now, more than three decades after the landmark Manchester event, the Dublin Working Conference presents an opportunity to contemplate a re-gathering and re-focusing of attention on possible new kinds of research encounters with technology and organization.

To suggest a move "beyond" interpretivism is not to deny or diminish its importance; rather we want to build on and extend this tradition in novel and interesting ways. Specifically, if the interpretivist turn drew its legitimation primarily from the philosophical field of epistemology – where the distinction between truth and meaning making was explored – less attention was placed on other philosophical domains, such as ontology, ethics and aesthetics. Thus, we invited contributors to explore a broadening of "conventional" interpretivist approaches to understanding techno-organizational phenomena. For example, we were interested in what we might learn by shifting attention from what specific technologies "mean" to what sociomaterial assemblages "do" in their becoming. More broadly, we invited submissions to explore the implications of the many "turns" – e.g. ontological, material, practice – that have been announced in social theory over the last twenty years in areas such as social anthropology, science and technology studies, feminist theory, geography and philosophy. What interested us was how these "turns" might offer alternative ways of encountering/enacting/performing techno-organizational phenomena.

Mapping "turns" in social theory is a perilous exercise, but our call for papers included a list of suggested topics, that we reproduce here:

- Process philosophy and ontologies of becoming [2, 3, 4]
- Practice theory [5, 6]
- Performativity [7, 8, 9, 10]
- Agential realism [11, 12]
- Non-representational theory [13]
- Materiality, embodiment and spatialization [14, 15, 16]
- Affect and the body [17, 18]
- Post-humanism and sociomateriality [9, 19, 20]
- Phronetic social science [21]
- Ecological approaches [22]
- Object-oriented ontology [23, 24]

Not all of these topics were addressed in the submissions received, but many received particular interest: affect, agential realism, becoming, embodiment, materiality, performativity, post-humanism, practice, process philosophy, and sociomateriality.

We received a broad-ranging set of papers from researchers in different fields who collectively share an interest in technology and organization. We clustered the twelve papers accepted for publication in this volume into four groups: *doing process research*; *exploring affect and affordance*; *considering communication and performance*; and *examining knowledge and practice.* In what follows, we provide a brief introduction to these four clusters of papers, but we begin with the contributions from our two invited keynote speakers.

Contributions from Our Keynote Speakers – Karin Knorr Cetina and Tim Ingold

In her speculative contribution "What If the Screens Went Black? The Coming of Software Agents", Karin Knorr Cetina enquires about a trading world where trading screens go 'half black'. That is, a world where algorithms become an increasingly significant actor in the enactment of trading decisions and transactions. Karin explores the differences between human agency and algorithmic agency to tease out some of the potential implications of such a postsocial world - a world in which algorithmic agency (trading algorithms) and human agency (human traders) become entangled in complex and more or less significant ways. After considering these differences, carefully, she concludes that it is of course trivial to say that algorithms are not human, that they 'lack soul'. However, it is perhaps less trivial to discover what our postsocial relations with algorithms might look like in the future - when algorithms do the 'touching'. In such a world, they, the algorithms, may 'touch' us in rather significant ways - 'as competitors and antagonists, as counterparties, as objects of attachment,' and so forth. The questions she raises, about the nature of the postsocial, are indeed at the centre of many of the contributions in this volume.

In the chapter that follows, "Thoughts on Movement, Growth and an Anthropologically-Sensitive IS/Organization Studies: An Imagined Interview with Tim Ingold", we present the outcome of an imagined dialogue with our other invited keynote speaker, Tim Ingold. Our aim, in producing this chapter, was to try to convey some of the strangeness and freshness that we have found in Tim's thought, with a view to stimulating IS/OS scholars to engage further with his work and ideas. The piece takes the form of an imagined Q&A session with Tim, which we have synthesized as a mash-up of excerpts from previously published interviews and writings. Tim was good enough to review and edit the chapter a number of times in the course of its production, which we think has contributed greatly to capturing his authentic voice.

Doing Process Research

The papers in this group all share a commitment to process ontology, offering three complementary discussions considering such an ontology historically, theoretically, and empirically. Each then effectively suggests how engaging in process research can provide valuable and novel insights to the study of IS phenomena.

The first paper in this cluster by Dubravka Cecez-Kecmanovic, "From Substantialist to Process Metaphysics: Exploring Shifts in IS Research", offers a historical and philosophical consideration of process metaphysics by comparing it to the more dominant approach of substantialism. Tracing the key assumptions informing IS research over time, the paper demonstrates that much of prior IS scholarship is rooted, explicitly or implicitly, in substantialist metaphysics. The value of adopting an alternative process metaphysics in the IS field is then discussed, and linked to the emergence of sociomaterial research that is strongly resonant with process metaphysics. By carefully articulating the implications of the two different metaphysics, this paper persuasively invokes the possibilities of new ways of seeing and studying contemporary IS phenomena.

The second paper by Chris McLean and Jeremy Aroles, "Critical Realism and Actor-Network Theory/Deleuzian Thinking: A Critical Comparison in the Area of Information Systems, Technology and Organizational Studies", offers a comparative assessment of two distinctive approaches to addressing the issues of process, performativity, materiality, stability and change. Focusing specifically on the notion of morphogenesis, the paper offers a useful comparison of two alternative approaches to enacting a process ontology: the ideas of critical realism on the one hand, and those of actor-network theory and Deleuze on the other. By attending critically to these two approaches and highlighting some of their different commitments, this paper offers helpful insights into the doing of process research.

The third paper in this group, "Affordance Lost, Affordance Regained, and Affordance Surrendered: The Becoming of Reachability on Social Media Platforms", is by Divya Sharma, Biswatosh Saha and Uttam Sarkar. The paper explores the notion of technological affordance through reinterpreting it in terms of a process ontology. Viewed in this way, affordances lose their essentialist character and emerge instead as accomplishments of ongoing flows and material movements. Drawing on process philosophy and

actor-network theory, the paper traces the becoming of affordances when the various agents involved in their enactment are not proximally co-present. This is illustrated with a reference to the use of Facebook for advertising, branding and marketing communication. This paper usefully demonstrates how ideas from process philosophy can provide fruitful means of extending the vocabulary of actor-network theory.

Exploring Affect and Affordance

Two of the papers in this group are concerned with the affective dimensions of social practices – urging us to take affect seriously in our studies of IS and organization, and offering some promising conceptual tools with which we might do so. The third paper gives detailed consideration to the concept of affordance, an idea which has been particularly influential in IS research in the last decade.

The first paper, "Ideological Materiality at Work: A Lacanian Approach", by Edouard Pignot, argues for the importance of attending to affect and ideology, and their respective materialities, in practice-based studies of technology and organization. To this end it introduces the work of a range of writers such as Lacan, Althusser, Butler and the so-called Lacanian Essex School, as a conceptual resource for exploring the relationship between the affective, the discursive and the material. In particular, the paper offers an account of "ideology as materiality" – i.e. as something that is embodied in our behaviour and rituals. As such, it points to promising new theoretical directions that might contribute to enriching practice-based studies.

This is followed by a paper by Alexandra Toll and Melissa Mazmanian, entitled "Inscribing Individuals into a Formalized System: The 'Labour' Performed by Affective Spaces". In this piece, the authors take up the challenge of foregrounding the affective dimensions of organizational life, by offering a fascinating description of the Family Law unit of a Californian court system as an "affective space". The focus is upon processes of formalization in which unique, and often emotionally highly charged, circumstances are rendered legible and inscribed into institutionalized ways of knowing and doing. In particular, it deftly illustrates how an affective structuration of the social is accomplished through the temporal-spatial regulation of organizational practices, and points to the skilful forms of "affective labour" that this involves.

The final paper in this group by Arto Lanamäki, Devinder Thapa and Karen Stendal, "When Is an Affordance? Outlining Four Stances", seeks to flesh out the idea of affordance which has become an important concept in information systems research over the last decade or so. Inspired by James Gibson's original idea, the concept appears extensively in various literatures, including information systems, though this proliferation has, the authors suggest, created a certain amount of conceptual confusion. The authors' contribution is to bring much-needed clarity to the concept, which they do by framing their inquiry around two key questions: what kind of relationship is an affordance and when is it? This, then, provides the basis for a novel taxonomy structured around four understandings of affordance: canonical affordance, designed affordance, potential affordance and affordance as completed action. The paper complements another paper on affordance by Sharma, Saha and Sarkar.

Considering Communication and Performance

The papers in this group have in common a concern with communicative practices and their sociomaterial performance in specific settings (e.g. museums, virtual worlds), examining how these enact particular identities and roles for certain audiences. By discussing empirical applications of their ideas, the papers offer valuable illustrations of some specific ways of doing sociomaterial research.

The first paper in this group by Thomas Martine and François Cooren, "A Relational Approach to Materiality and Organizing: The Case of a Creative Idea", offers an alternative to the sociomaterial notion of entanglement. Arguing that this term reinstates the separation of the social and the material that it attempts to transcend, the paper introduces the notion of aspectuality whereby materiality and sociality are seen to be two different and intractable aspects of everything that exists. Integrating the notion of aspectuality into fieldwork within the CCO (communication as constitutive of organization) tradition, the paper illustrates how the production of a creative idea by teams participating in a museum event may be understood through examining the enactment of the various relations that materialize it. In so doing, the paper offers an interesting alternative for examining sociomaterial inseparability in practice.

The ongoing conversation about sociomateriality is continued in the paper "Enactment or Performance? A Non-dualist Reading of Goffman" by Ella Hafermalz, Kai Riemer and Sebastian Boell. The paper undertakes the important task of interrogating two of its key concepts: enactment and performance. Using a hermeneutic approach, the paper traces the multiple interpretations of these two terms, cumulating in a relational reframing of Goffman's treatment of performance. The subtle (re)reading of Goffman evident in the treatment allows for the development of a non-dualist understanding of performance as a complex, collective sociomaterial activity that can be usefully applied to studies of IS phenomena. In offering an alternative rendering of some of Goffman's ideas, this paper contributes interesting ways to enliven the sociomaterial research agenda.

The third paper in this group, "Performing Cyborgian Identity: Enacting Agential Cuts in Second Life", by Ulrike Schultze, develops an account of how individuals continually perform their identity as a dialectical synthesis between the actual and the virtual (their physical and digital bodies). Informed by the work of Deleuze (through the account by Shields), the paper understands the virtual as a potential reality that is counterposed to the actual rather than to the real. Drawing on Barad's agential realism, identity practices are understood to entail specific agential cuts that perform cyborgian identities. Boland's engine of inquiry analytical framework is then used to generate a number of valuable insights into the identity practices that enact, more or less successfully, the hybrid cyborg identity. In doing so, the paper demonstrates the importance of agential cuts, not merely as epistemic practices, but also as everyday organizing practices.

Examining Knowledge and Practice

In this group the papers explore knowledge, meaning-making and practice using different conceptual approaches in various settings. The first paper engages with "The

Mangle of Practice", a science and technology classic by Pickering, the second draws on Knorr Cetina's innovative sociological work on "synthetic situations", and finally the third paper combines French cultural historical psychology with the work of developmental psychologist Vygotsky.

In tune with our theme of exploring "other" ways of experiencing theory, the authors of "Performing Research Validity: A 'Mangle of Practice' Approach", Robert Johnston, Kai Reimers and Stefan Klein, challenge us to join them in an exploration of a performative notion of research validity. They bring key principles of Pickering's theory of mangling into play as they "go to work on and with" a learning community infrastructure. In so doing, they generate process-centred insights into the performance of truth, significance and objectivity that bring us to closer to understanding the distinctions between the performative and representational idioms. Their engagement with the learning community "infrastructuring" serves to theoretically acknowledge and practically advocate strong involvement with our practice research "object". Thus we are encouraged to reflect on "how connections between knowledge and the world are actually made in the practice of researching".

Drawing on data from a longitudinal study of the offshore oil and gas industry, Elena Parmiggiani, Eric Monteiro and Thomas Østerlie, in "Synthetic Situations in the Internet of Things", explore "synthetic situations" a concept authored by one of our keynote speakers, Karin Knorr Cetina. Their findings illustrate how at-a-distance meaning-making is generative rather than representational. This surely inspires further research into the practices through which algorithmic phenomenon constitute the phenomena under inquiry. The authors call for further studies of sociomaterial knowing not only in contexts characterized by physical inaccessibility but other situations where a dependency on Big Data and the Internet of Things may emerge.

In their paper, titled "A Developmental Perspective to Studying Objects in Robotic Surgery", Laura Seppänen, Laure Kloetzer, Jarno Riikonen and Mikael Wahlström offer an "interventionist activity theoretical approach", specifically the method of self-confrontation, to study technology-mediated practices – robot surgery in this case. A key point in the paper is that robotic surgery allows for real time video capture of the sociomaterial practices. This then facilitates the process of self-confrontation, where surgeons are shown excerpts from the video stream and asked to describe as precisely as possible the gestures and actions that were observable in the video, whilst also questioning what they see themselves doing in the video record. This facilitates the formation of new relationships between the objects, their actions and multiple other issues in their collaborative sociomaterial work practices. Through the intervention, different kinds of objects (material, psychological and social) become enacted in a concrete, situated, and relational manner, leading to the development of new practices. This paper suggests that this mode of research can contribute to studies of technology and organization by revealing the complexity and evolution of objects in and through sociomaterial practices.

Conclusion

In the questioning of interpretivism in our call for papers, we sought to invite a rethinking of existing approaches and provoke consideration of new encounters with IS phenomena.

With the contributions in this volume and the conversations at the conference, we hope that ideas and insights have been generated that will help to shift assumed positions and open up new possibilities for researching technology and organization.

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Keynotes and Invited Papers

What if the Screens Went Black? The Coming of Software Agents

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Trading screens are not supposed to be black. In fact, when we see them on trading floors, on TV, or in media centres, they attract us with catching colours and blinking information. They project urgency, speed, and power – the power of big money, the power of winning and losing. When we are near them, we feel their heat. We want to give in to their considerable attraction. We want to be players of the game and part of the action.

Of course, the screens are only a medium. What beckons us is the market. All the beguiling signals come from a market that moves – prices, volumes, ratios, differentials. They move in a context and in response to it. The context, of course, also moves, but usually more slowly. How often do politicians make decisions? How often do tsunamis strike? The context is everything that happens in the world that may have an impact on the market. But that everything happens on a human schedule and is adapted to how we conduct our lives and how nature and the environment conduct theirs. What parts of the context impact a market? The question is ongoing and difficult. Should the stars and their movements have a presence onscreen? Astrologists may think so, but Reuters and Bloomberg don't, and they are two of the largest companies feeding material to the screens. Is Namibia a country that should be present in a global financial market? It has its weekend and peasant markets, to be sure, and some stocks, but its gross domestic product is shrinking and is little more than a rounding error on the trillion dollar economies that count. Trading screens cover the three major time zones and not every little nation and group that populates the globe. Even with these restrictions, however, trading screens are rich in texture and information. They are not just surfaces. Behind every window, dozens of others can be opened and closed. Calculations can be called up and made on the spot. Information can be requested and is instantly available, at all times. Social relations carry on and jokes are made. And, of course, one trades through the screen, through the electronic channel. All trading in currency markets, for instance, is conducted electronically.

Screens are rich, and they are not only there for trading. They are the world for those who sit in front of them. The question posed at the beginning of this essay is larger than it may have initially seemed. When the screens go black, a world goes black. But what happens if that world goes black?

Twenty years from now, even in ten years, the answer could be "nothing at all". The screens project the market, but in the future the market might carry on just as well without screens. The contextual information will be necessary and will remain available – available to programs that receive and decode it without displaying it onscreen. The scopic regime under which electronic financial markets operate could simply

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migrate fully underground. Why "scopic" and why "regime"? Financial screens are like scopes. A scope is an instrument for observation. A periscope, for example, protruding from the surface of the ocean, can give a submarine a 360-degree field of view – a view richer and deeper than that of the naked eye. A telescope, using lenses or mirrors, can "see" the objects that circle us on planet Earth – it brings close what's behind the twinkle in the sky that the eye can see. The screens that project the market are not optical instruments, of course. They bring the activities of globally dispersed participants near and condense them onscreen, making them visually available to everyone connected to the information technologies that produce and transmit the screens' content – in real time and in real speed. News about changes in the market's context augment financial content: political activities (e.g. elections), announcements related to the economy (e.g. Fed forecasts and earnings calls), social events (e.g. riots), cultural trends (e.g. tourism), and natural disasters (e.g. floods). The observational system at the centre of a fully electronic financial market then uses its knowledge of market transactions and external events to perform instant analyses of the material. It combines new data with historical content and enriches both with financial indicators processed elsewhere and released to the screen. This extension in the scope of financial transactions to, in principle, all that is globally pertinent to the market, as well as to the analysis of these materials, is part of the notion of "scopic". A scopic regime then simply refers to a combination of technological media, software, and information that enables a global financial market. I call it a regime because scopic media rule the market, so to speak. Without these media, the market could not operate. Of course, the actors in the market could try to go back to telephone trading, or even to voice trading as it once existed in alleys and streets. But unless all computerized infrastructures break down, no one in the foreign exchange market, with its $4 trillion daily turnover, could survive. A scopic regime forces actors to participate in the current venue if they want to be in the market – though it also allows and even encourages improvements, customization, and changes of venue. The point of the current venue is that it works by making the flow of the market visually available in augmented fashion for human actors to perceive, interpret, and act upon. It also streams the market, putting it in a visually running sequence. In other words, it continually updates the market as new information flows in and old information flows out (or scrolls down the screen).

When things migrate underground, something splits off the huddles of traders and screens of the trading floors we know. When it splits off and turns inside, so to speak, another world opens up underneath the level of human agency: that of data centres, programs, and electronic connections. This is the environment of algorithms, or as we may want to think of it, of software agents. Software agents operate underground already, but they only partly substitute for humans. Human traders are still on the floors and in exchanges, watching the market, and watching what their "tools", the algorithms, do. Traders refer to algorithms as their tools. Having a tool suggests that you have control over it and that it serves you. In the foreign exchange market, for example, as judged by evidence I have from two top banks in worldwide trading volume, trades valued at over $5 million (first bank) or over $50 million (second bank) are executed by human traders. Those valued less than these amounts are left to algorithms, but human traders oversee the activity. The British Foresight report that investigated the future of

computer trading just recently stated that: "Despite the increase in computer power, processing speed and sophistication of computer algorithms, the present day financial markets still involve large numbers of human traders". And it continues: "There are good reasons to expect, for the next decade or so, the number of human participants in the market will remain significant" [1] (p. 32).

As the timeline and the way things are hedged in this formulation suggest, the presence of algorithms already is quite significant. Today, traders expect that when things migrate underground fully, perhaps after the next decade, some human traders and others are likely to remain on the floor and continue their work. For current traders, it is hard to imagine a market without human participants, or without screens. Such an arrangement would not be possible, they tell me, since someone has to be there to watch and think and to develop more tools. Let's assume they are right and ask: what it would mean for our trading culture and sociology if the screens went "half black"? What would it mean if traders were still around but had limited roles to play, and underground agents had taken over plenty of trading functions? I want to turn to this shortly, but before I do so, here are some data and definitions, and an explanation of algorithmic trading.

1 Electronic-Automatic-Algorithmic: Some Data and Definitions

The Bank for International Settlement (BIS) described the rapid growth the foreign exchange market experienced between 2007 and 2010, when it was last measured, as the "the $4 trillion question: what explains FX growth since the 2007 survey?" [2]. The foreign exchange market had grown during that time, the time of the financial crisis (!), from a daily turnover of $3.21 trillion to approximately $4 trillion – after an already unprecedented rise in activity by 69% between 2004 ($1.420 trillion) and 2007. The $4 trillion question can be answered, the BIS says, by a 20% surge in high-speed buying and selling by computer programs using algorithms.

The number of nonfinancial institutions, or retail traders, also increased during the period, making up almost 10% of the global market in 2010 [2]. These non-banks and day traders increasingly use algorithms offered to them through the trading platforms they employ. Several sources, including the BIS, estimated the total volume of automated trading based on algorithms in the foreign exchange market in 2010 to be about 25% [3] (p. 11). Traders interviewed in 2013 thought it had remained roughly around 30%. The volume varies between banks, as some banks make a stronger push towards automated trading using algorithms than others. Barclays, for example, was said to have only four spot traders left in foreign exchange, and they manage trades worth over $50 million – everything else is done automatically through the "Algobook". One of the two largest Swiss banks joined the push towards algorithmic trading, and the other appeared to still ponder it in 2012 (interview data). As the BIS report noted, "FX dealing banks unsurprisingly do not welcome the compression of spreads" associated with the rise of high frequency trading, one of the main trading strategies using

algorithms [3] (p. 9).[1] The total number of this sort of automated trading is considerably higher in the stock market. The Foresight Report estimated that the percentage of trades that are automated can be as high as 60% in US equity trading, with estimates ranging from 30% to 60% for European equity markets. Equity markets are not global – equities can be purchased or sold globally, but they are organized regionally in exchanges – hence the differences between Europe and the United States [1] (p. 43).

Automated trading is electronic trading that depends on one or more algorithms at some stage of the process [3] (pp. 3, 5). Electronic trading that is not automated uses computers to trade, exchange information, chat, and everything else scopic media allow one to do through a screen. Electronic trading is, then, manual and "high touch": a trader hits a key to trade what's on offer on an electronic broker system, which displays the bid and ask prices and volumes onscreen, or a trader sends a message to deal directly with a counterparty using an onscreen conversational dealing system. Electronic trading also can be "medium" or "low" (human) touch, and only then is it algorithmic (and electronic) trading; more or less, the work of human traders – scanning prices and executing trades – is performed by algo-tools. When does it become what one might call "algo" touch? There are various types of trading based on algorithms; for example, they include the vast area of algorithmic execution, in which the computer program is responsible for executing a trading order. This sort of algorithmic trading "is the bullet, not the finger on the trigger", since the algorithm isn't making trading decisions [4] (pp. 5–7, 12–15). But algorithms that make trading decisions are increasingly common, and are based on models and incoming information. For example, they can read the news and interpret current events, and in response they can execute a trade and hedge against it. When the algorithm has its finger on the trigger, we can extend the current parlance and describe it as "algo" touch. Humans still outperform algorithms in analysing the semantic information carried in human-readable data streams, which range from written stories to audio and video sequences and tweets on social media websites. But news analysis performed by algorithm is a significant focus of research, with the goal of enabling computers not only to understand the numerical information of market prices, but also to understand non-numerical information. As this research advances, we will approach the "algo" touch mode, in which no human trader will be involved in trades, but in which software agents will be essential. Of course, the human touch in this case will just shift to other professions: for instance, to engineers and programmers that develop the software agents.

Is a software agent a professional? An algorithm is simply a set of instructions for accomplishing a task, according to various definitions. It may be a formula, or a set of rules, a set of steps, or on the most general level an approach to solving a problem. The latter definition sees an algorithm more as an idea behind a set of instructions. There are likely to be many possible solutions to any problem, and for that reason there can be many different algorithms trying to accomplish the same thing. Even when the problem seems as simple as finding an entry in a phone book, there are different ways, as Durbin explains, of solving it: we can start from the beginning and flip pages until we find the

[1] "Spreads" here refer to the difference between bid and ask or buy and sell prices from which traders profit.

name, or we can guess where in the book names with the first letter of the entry might appear and flip back and forth till we find it, or we could possibly work with an index, if one exists.[2] On the programming level, an algorithm is a computer code. When you write a program to filter the light in a certain way so as to create a specific photographic effect, you have created an algorithm. The use of algorithms in trading is not new. The Electronic Broker System (EBS), developed by a consortium of banks in the early 1990s, is a combination of programs that on the most basic level helps prospective buyers and sellers find one another. It does this by sorting incoming trading requests according to the best bid and ask prices, putting them in a sequence, by distinguishing and adding up volumes, by supplying the next price once a price–volume offer has been consumed, and so on. To do this, it needs criteria and information and the capability to sort, compare, archive, etc. An order-executing algorithm, for example, may simply perform order slicing; that is, it may split a large order into smaller segments of "child orders" that are put on the market (or sent to the exchange) sequentially, perhaps every hour. The goal is to reduce the impact one large order can have on the market price of a given security. A human trader likely would initiate this order by placing it in a more sophisticated way, for example, by placing individual child orders on the market at irregular times. A trader might also consider price movements before executing a portion of the order, and so on. Algorithms evolved at least in part by becoming more sophisticated by imitating experienced traders. For example, they learned to include more randomization – to elude market participants able to identify the linear actions of a tool that trades according to a fixed schedule. Then they became responsive – they learned to execute orders in response to live market volume – instead of using historical volumes to determine when to execute a child order. And then, according to Johnson, they started to base their responses on particular types of analysis or conditions, evolving within categories of algorithms for a while, before a new generation of algorithms took hold [4] (p. 14). The first generation of algorithms learned from humans – it is the one that evolved from a linear fixed execution schedule to responding to market conditions in order to reduce market impact. The second generation learned from theories and models as it became more price and cost sensitive – it used transaction cost analysis to estimate and reduce transaction costs. That is when algorithms began to move beyond trying to imitate the behaviour of experienced traders. The third generation became reflexive – algorithms learned to examine and use data and venues that the market itself provided. For example, they learned to examine order books, which became more widely available as markets transitioned to electronic trading platforms, and to use more than one execution system, which also became available – e.g. electronic crossing networks (ECNs) and alternative trading systems (ATSs). This generational mobility will continue naturally, one assumes, though it may also be pushed forward by system-internal dynamics. Algorithms can be copied, which can eliminate their advantage. As a consequence, one looks to identify new advantages. The most sought after of these in the last ten years has been time advantage, which is used by high-frequency trading (HFT).

[2] I take the example from [5].

HFT is another subset of automated trading. It uses the famous processing power of computers to monitor and analyse thousands of variables to optimize trades. The latency periods exchanges achieved in 2010 were below 10 ms – a real blink of an eye takes 300 to 400 ms. HFT's first trademark characteristic is the use of extraordinary high speed together with sophisticated algorithms, a mix that is hardly beatable by a human being. IBM's Deep Blue began to overtake human chess masters in the late 1990s;[3] HFT trading took off only around the middle of the 2000s and reached volumes accounting for more than half of stock trading in the United States in 2010. There are signs that this expansion is ending, given an increase in competition, the high costs of HFT, and new regulatory restrictions. HFT firms may co-locate their computers at exchanges to improve the speed of computer linkages, and they use data feeds offered for purchase to gain processing advantages over others in the HFT universe. One example that recently has caught the attention of US regulators is the sale of early financial data by exchanges and information provider firms like Thompson Reuters and Bloomberg. Thompson Reuters, for example, offered the release of the University of Michigan's consumer confidence index, a market-moving economic indicator, two seconds early to paying clients, and the company in turn paid the university "at least $1million a year" to distribute the data early to its customers [6]. NASDAQ and the Chicago Mercantile Exchange promise to deliver NASDAQ data to Chicago customers two milliseconds faster than they are otherwise available using microwave transmission, at a cost of $20,000 per month to subscribers. Such costs of the race to receive information first, together with the costs of shaving additional milliseconds off trade times through the co-location of servers with exchanges and through building new data connections (e.g. from Chicago to New York), make it harder to generate profits, particularly during market downturns. Traditional investors, like mutual funds, have embraced the high-speed industry's automated strategies and moved some of their business away from exchanges that are popular with high-speed traders. "Profits from high-speed trading in American stocks", the *New York Times* reported in October 2012, "are on track to be… down 35% from last year and 74% lower than the peak of about $4.9 billion in 2009", citing the estimates of a brokerage firm [7]. "Wells Fargo and JPMorgan Chase each earned more in the last quarter than the high-speed trading industry will earn this year", it added. HFT firms also were accounting for "a declining percentage of a shrinking pool of stock trading, from 61% three years ago to 51% now", according to the Tabb Group, a data firm. The report also mentioned that firms have been cutting staff, or even have shut down [7].

HFT has several other features having to do with the short time horizon of trading. For example, traders hold positions only for very short periods of time, they may submit large numbers of orders only to cancel them soon thereafter, and they end the trading day "flat", without carrying significant positions (inventories of an investment instrument) overnight.[4] Observers also note that HFT firms implement typical trading strategies such as classical arbitrage, which exploits the difference between actual

[3] For a brief history of the respective competitions see the Wikipedia entry: http://en.wikipedia.org/wiki/Computer_chess (accessed 16 July 2013).

[4] See the Foresight report [1] (pp. 42–43) for the summary on which my discussion is based.

market prices and prices implied by "no arbitrage" conditions; latency arbitrage, which exploits the short time lag between the moment a trade occurs, the moment an HFT player detects the resulting change in the security's price, and the moment an update is made to the price quoted by market making traders;[5] liquidity redistributing strategies, which detect imbalances in order books and pricing discrepancies across trading platforms; and "complex event processing", which exploits properties of currency pairs (e.g. correlations among pairs of currencies and other assets) to find profit opportunities. There are also – to return now to the more general level of automated trading – different styles of investing by which one can classify the use of trading with algorithms. If HFT is one style, statistical arbitrage is another. This is a term used for trading that spans longer time frames than HFT, but statistical arbitrage seeks to exploit mis-pricings between correlated assets in a similar way. Quantitative trading based on proprietary models whose actual mechanisms are not disclosed is a third style. Some authors, like Johnson, reserve the term algorithmic trading for the execution of orders [4] (pp. 3–5).

2 Transformations

What little I have said about types of trading with algorithms and some of the issues this raises may at least suggest one thing – if the screens go black, or more realistically, if they go just half black, and the world that emerged with digitalization since the 1980s fades into history, then another world will rise in its place, one full of actors, business models, attempts at advantage taking, and sophisticated trading strategies. And while there are important differences between the former and the latter, markets will not end, and in some cases, as in the case of the Foreign Exchange Market, they may stealthily become larger and richer rather than smaller. The new world will be curated and monitored by humans. What's the difference between a market curator and a trader? Or more broadly speaking, what is the sociology of the new world with its understructure of software agents that work, make decisions, and determine investment success?

And what happens to what I called the scopic regime when algorithmic traders become widely used? The first answer is that algorithmic traders and their effects have to be monitored and observed. Algorithms move underground, or rather, into the belly of computer networks, where computer programs do their work. They are software agents that traders don't get to know face to face on trading floors or during happy hour at a bar. What they do will be known through the textual descriptions created for them, but in the market we will know them mainly through their effects. Traders may not trade anymore below a certain volume – employing their algo-tools for that purpose – but they surely will continue to monitor the market, the price and volume movements that result from human and algorithmic trading, and they will continue to monitor outcomes of software agents' activities. Automated trading systems will follow their

[5] Market makers provide liquidity to the market, meaning they are at least in principle obligated to buy or sell when a request is made. They attempt to profit from the difference between the buying and selling price (the bid–ask spread).

logic regardless of the outcome, as Mary Schapiro, then chair of the Securities and Exchange Commission, told a congressional committee in the wake of the flash crash of 2010.[6] Human monitoring is needed to prevent this from happening, in addition to the circuit breakers that have been implemented in exchanges to automatically halt trading when prices of stocks fluctuate by more than a certain percentage.

These may appear to be minor changes in trading practice, but they reflect a tectonic shift on a macro level that is less benevolent for those they affect. The most drastic change we witness today occurs on a professional level, and its most obvious effect is the historical replacement of one elite profession by another, in which the losers are human touch traders, and in exchanges, where the losers are voice brokers. The winners for now are professionals with a higher education and one or more degrees in the relevant disciplines: software engineering, mathematics, statistics, physics (physicists tend to be trained in both and know some informatics), and finance. The institutional winners are speed-focused trading firms, hedge funds, or proprietary desks and funds internal to banks, in which some of the new professionals work. To some degree, and in some areas, the displacement involved a power struggle; traditionally powerful and dominant exchanges, for example the New York Stock Exchange (NYSE), were slow to adapt to the new realities, and in the process lost volume and status. The NYSE, whose roots go back more than two hundred years, once held a preeminent market position at the apex of the world financial system, but it now accounts for only 22.5% of all stock trading. The replaced category of actors subsequently has moved into asset management, private trading groups and firms, or has been retrained. For example, there has been an exodus in recent years of traders from (investment) banks to proprietary trading firms and hedge funds, which have greatly increased in number. "Hundreds of talented traders" have left as banks shrank their trading operations in anticipation of the regulatory overhaul, the Volcker Plan, which would bar banks from such proprietary trading. "They are armed with skill sets", this report continues, "that are in demand at hedge funds. Some are launching their own funds – a total of 549 new hedge funds were launched during the first six months of this year (2012) …while others are joining established ones… Rather than wait for banks to close their 'prop desks,' many star traders have gone into business for themselves over the last couple of years" [10]. The demand illustrated here may help explain the lack of a power struggle in some areas, but this is only part of the story. Many former traders, including those with technical and organizational skills, simply lost their jobs, and it is unclear where they went. The new skill sets expected of human participants in hedge funds often involve a combination of quantitative skills and programming knowledge as well as trade design and fund management skills. Here is the wording of a recent ad accessed on the web in May 2014:

> A Hedge fund in Greenwich is seeking a Quantitative Research Analyst to join their Global Currency Portfolio Management team. This is a great opportunity to work on the cutting edge of quantitative investment & portfolio strategies for FX. Responsibilities will involve: (1) building trading strategies, tools & applications for global currency trading, (2) portfolio construction/optimization, and (3) FX/Currency exposure management. Applicants should

[6] As reported in [8]. See also [9].

> have: 1+years' experience working with economic and financial databases: very strong programming skills in Java, C++, SQL and Excel: a Ph.D. graduate or Ph.D. candidate from a Top School in Computer Science, Math or Financial Engineering: and superior communication skills. Currency strategy experience is strongly preferred.[7]

What about the non-human participants, our algorithmic agents? Their preferred qualifications are less mixed, as algorithms tend to be specialized. What they can do technically within their specialized functions already has been illustrated in the previous section. But how should these functions be executed, or, in other words, what properties do we look for in a trading algorithm? We won't find job descriptions for software agents on the web, but, luckily for us, computer science itself talks about desirable properties of algorithms and how these properties should be determined. Developing a solution to some problem typically involves at least four steps: "(1) designing an algorithm or step-by-step procedure for solving the problem, (2) analyzing the correctness and efficiency of the procedure, (3) implementing the procedure in some programming language, and (4) testing the implementation".[8] Analysing the qualification of an algorithm in terms of its efficiency in the present context means, first and foremost, measuring its speed in executing tasks. Speed depends on several factors, for example:

- the size of the input ("searching through a list of length 1,000 takes longer than searching through a list of length 10")
- the algorithm type ("Unordered-Linear-Search is inherently slower than Binary-Search")
- the programming language used ("interpreted languages such as Basic are typically slower than compiled languages such as C++")
- the quality of the implementation ("good, tight code can be much faster than poor, sloppy code")
- the speed of the computer executing the code.

In analysing the efficiency of an algorithm, Aslam and Fell [11] continue, one typically focuses on the speed of the algorithm as a function of the size of the input on which it is run, and one determines the number of program steps or some count of other computer operations as a function of the input size – the actual time, however, still also depends on the programming language used, the quality of the code produced, and the gigahertz (the speed) of the computer. In other words, an algorithm needs to live up to very particular and measurable criteria. Speed is just one of these criteria, though its importance in trading cannot be overestimated. Other criteria include precision (the more accurate the solution is, the better), memory (the less required, the better), optimization (some instructions, when repeated, may lead to learning and greater success in meeting a particular condition), and so on. If this sounds different from how we "size up" humans, even when they compete over speed, when they run a race for instance, then that's because it is. Algorithms are not expected to have the same

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[7] See www.simplyhired.com/job/foreign-exchange-trading-quantitative-analyst-ph-job/greenwich-based-hedge-fund-finance-industry/z6bw2hxuqg (accessed 12 May 2014).

[8] For this and the following list and its explanation, see [11].

Table 1. Different kinds of "subjectivities"

Human actors	Software agents
Emotion	Unemotional
Interpretation (taking role of other)	Scientific
Discretionary judgements	Dumb
Discipline	Seeing and reading
Self-regulation	Regulation via risk assessment
Research in delayed time	Research in real time
Division of labour	Division of labour
	Seductive (fast and cheap)

properties that humans do. Although they started out more or less imitating human behaviour in trading and are still advertised as being capable of doing exactly that (see [12, 13]) algorithms do think differently from "us". "An algorithm is a well-ordered collection of unambiguous and effectively computable operations that when executed produces a result and halts in a finite amount of time" [14] (p. 9) – I know of no account according to which a human being would fit this description.

Let me summarize, then, some of the differences between "us" and the algorithms that traders confront in the market, before ending with a brief outlook. The qualities of "them", in contrast to those belonging to "us", are taken from what humans dealing with algorithms attribute to them.[9] Table 1 offers an overview.

The first difference between humans and algorithms is that humans have emotions and that algorithms don't. Neurophysiologists think emotions are needed for intelligent human behaviour, but traders, taking their cue from the trading lore and culture, often maintain that emotions must be curbed, and that they can be controlled by "discipline", a second characteristic and skill humans have.[10] Trading culture recommends that traders be "disciplined". A trader should take a view of how a stock or currency or other financial instrument will do within the relevant time period, and stick with it. The trader should liquidate a position when a price exceeds a pre-set limit, or when it gets too low, rather than wait and see if the investment will recover. One of the relevant stories that circulates among investors is about a famous trader who would leave the trading floor and go to the movies whenever markets were in turmoil – in order to maintain discipline and not react in impromptu ways. Discipline is recommended and taught to novices working on the floor to rein in their emotional responses. Algorithms, of course, don't need to have discipline, because they are disciplined by nature – programmed to do certain things and not others, and programmed to follow rules.

A third difference is that human beings are communicative actors using natural language rather than formalisms. Natural language words mostly have no fixed, unambiguous meaning. Meanings are pragmatic. They depend on context and the way

[9] These include my own interview sources and writings on algorithms by insiders in algorithmic trading. See for example [15].

[10] For an example of a neurophysiologist who thinks emotions are needed for intelligent human behaviour, see [16].

words are used. Think of the fact that most dictionary entries have more than one listed meaning, and then consider the various ways individual words can be used towards different ends. Indeed, users may give a word nearly any meaning they want when they speak metaphorically or poetically. Natural language utterances and writings require interpretation, a skill humans learn by talking, textual exegesis, and training. For example, humans grow up "taking the role of the other" in Mead's famous phrase. They learn by putting themselves in others' positions and seeing the world (and themselves) from other points of view. That helps with decoding and understanding others' intentions. Humans effortlessly and without explicit awareness pay attention to gestures, reading them as additional information. And they use all of their senses and not just their vision or prefrontal cortex to "understand" what they see. As they grow into a particular language and culture, they acquire a huge repertoire of implicit knowledge that they can bring to bear on familiar and unfamiliar situations. Based on their understanding and experience, human traders, for instance, usually have control over their trading decisions, using their own judgement. They can make discretionary judgements. They are not bound by the data and calculations they receive from analysts and sources on their screens, and they usually are not bound by the view their employer, say a global bank, has of the market. Algorithms don't make discretionary judgements, and they are programmed to respond to data. Things get murkier, however, when we ask whether algorithms have interpretive skills. The answer is that algorithms currently are learning to read and decode texts in order to interpret incoming news items correctly, but, as of today, they are still making substantial errors, for example, by taking messages literally and without taking into account circumstances and contextual clues. One recent example is a hacked Twitter message sent out by the news agency Associated Press on 23 April 2013: "Breaking (news): Two Explosions in the White House and Barack Obama is Injured". The message was wrong, but it caused the Dow to plunge by 140 points, the dollar to yen exchange rate to fall, and a downturn in bond yields, all within seconds. "No human believed the story. Only the computers react to something that serious disseminated in such a way", a Wall Street trading director said about the market's reaction. Human traders, seeing the selloff, checked the tweet against other, more reliable news sources and concluded the tweet was incorrect, and stopped the market plunge (Associated Press also quickly discovered the error).[11]

Human beings have a moral sense. They can regulate their own behaviour, and they tend to continually and effortlessly monitor rule compliance in others. The phenomenon that Wall Street does not conform to or even understand the moral expectations of Main Street is no contradiction to this assertion. Wall Street, too, has its morals, but its moral rules have little to do with what the external world thinks and wants. Wall Street morality is part of a law of trading practice, a *lex mercatoria* enforced by traders during trading. It's a law oriented to managing orderly behaviour among insiders without real concern for outsiders. Internal self-regulation is needed in markets in which there are no centralized national exchanges. Currency markets are a

[11] For a fuller report, see the following article: www.dailymail.co.uk/news/article-2313652/AP-Twitter-hackers-break-news-White-House-explosions-injured-Obama.html#ixzz2dxXoCW3t (accessed 18 August 2013).

case in point. As over-the-counter markets, they are not subject to the standards and disclosure requirements of exchanges, which are much more regulated. Like derivatives markets and financial markets generally, currency markets lobby for self-regulation, and governments have set them free – partly, perhaps, in response to lobbying, but surely also to prevent the problems fixed exchange rate regimes tend to incur. Algorithms can be programmed to stop doing what they do under specified circumstances, but they clearly don't have the "moral compass" we attribute to humans. In fact, algorithms tend to be controlled by risk management techniques rather than by a moral sense and ethical considerations.

There are more differences between algorithms and humans, as the trading side sees it, and one is that while we consider ourselves intelligent, and undoubtedly are, algorithms are intelligent and simultaneously dumb. They are capable of making informed decisions, but they will make them "scientifically", strictly on the basis of data they receive and the analysis they conduct or that other algorithms conduct for them. The downside of this is that they cannot think "outside the box", outside what they are programmed and optimized to do. Algorithms can learn, for example, by going through iterative cycles of runs, within a given framework, but they appear to be less adept at responding circumspectly and cleverly to new situations. They can also be imitated and "out-programmed" once a party interested in doing so understands what they are designed to do. Humans, of course, have major drawbacks, too. One is their limited speed, the dimension along which algorithms always will outperform human beings. Their speed allows algorithms to conduct research practically instantly, for instance, while human analysts or traders need a substantially longer period of time for similar results. Both humans and algorithms tend to specialize in certain tasks and enjoy a division of labour, though algorithms surely always were more specialized than humans. This difference may become more pronounced in the future, as the ad cited above suggests. One of the seductive features of algorithmic trading is, of course, that once an algorithm has been developed its continued operation costs less than the labour of a human trader. This is a major driving force for algorithmic trading.

3 Our Postsocial Future

Algorithms think and act quite differently from us, as we on the human side see it. Notions such as "thinking", "intelligence", and others mentioned previously in this essay, such as "seeing", "reading", and "acting", suggest an agent. Are algorithms "tools", a notion my interviewees assigned to them, or are they "software agents", a term that denotes agency? The (financial) literature on algorithmic trading occasionally draws an analogy between algorithms and robots, and this analogy points to software agents. Herein lies another potential transition we confront – the transition from algos to agents, from what is merely a tool and instrument for human traders to traders that act on their own but are algorithmic in nature. The latter have to be reckoned with as strategic parties in human interactions, the former will do their work mainly by tooling us up. They are our "aides" with only instrumental rights and obligations. When we call these tools software agents, we elevate them to a higher status and suggest that they,

too, are autonomous entities of a sort that can sense the environment and respond to it on the basis of specified goals. One way to draw the line between tools and software agents is to revert back to the distinction between algorithms that are the "bullet" and those that are "the finger on the trigger" – between those that merely execute trading decisions and those that make their own "decisions" on the basis of programmed analyses and models. One prediction one can make is that both types of algorithms will exist alongside each other in the future. The increasing volume of trading conducted by software agents poses interesting social science questions which will need to be explored. How do we have to imagine the interaction, on a microsociological level, between a software agent and a human agent? Software agents lack the "deep" play of humans – their generative ways of playing meanings, emotions, and existence. Relationships with these agents will not have the same quality as social relations. But we are likely to project some of our social relational expectations and fantasies onto them, and they may engage and attract us. I have used the term postsocial for object relations of this kind and have suggested that such unfolding, information-rich entities that lack completeness of being (like a market) may lure us into such relations [17]. The algorithm-based world that human traders and financial markets already inhabit, for instance, surely is a postsocial world. It's trivial to say that algorithms lack soul. But it's perhaps less trivial to find out what our postsocial relations with algorithms will look like in the future. When algos do the "touching", as I envisaged in the beginning of this essay, when they trade according to decisions they themselves make, they may also "touch" us – as competitors and antagonists, as counterparties, as objects of attachment.

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Thoughts on Movement, Growth and an Anthropologically-Sensitive IS/Organization Studies: An Imagined Correspondence with Tim Ingold

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In what follows, we present the outcome of an imagined dialogue with Tim Ingold on possible future directions for an anthropologically-sensitive approach to studying Information Systems (IS) and Organization Studies (OS). The aim is to try to convey some of the strangeness and freshness that we have found in his thought, with a view to stimulating IS/OS scholars to engage further with his work and ideas. The piece takes the form of an imagined Q&A session with Tim, which we have synthesized from excerpts of previously published interviews and writings.

1 Q: Liveliness, Movement and Engagement Are Central Themes in Your Ecological Approach to Anthropology. Can You Tell Us a Little About Where These Themes Came from?

I am the son of a prominent mycologist and grew up with that sense of science as something you do in a very homely way, involving observation and drawing. And I think that is somehow very deeply embedded in the way I think.

My father's scientific practice involved walks along river banks where he would collect the scum that often accumulates in brackish pools, bringing it home in glass phials to be investigated under a microscope set up on our dining room table. He had improvised an elaborate contraption involving a pile of volumes of the *Encyclopaedia Britannica*, a glass plate and an early version of the anglepoise lamp, which allowed him to project the forms of the fungi revealed under the microscope so that they could

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be accurately drawn. This he did with the utmost care, using a mapping pen, Indian ink and high quality Bristol board.

Though he would never admit to it, this was his way of honouring the forms of nature, of not just contemplating their beauty but knowing them from the inside; and the results were true works of art. He loved his fungi. But perhaps what I did not realize at the time was that as a field of the botanical sciences, mycology is a deeply subversive discipline. Fungi, you see, just don't behave as organisms should. We typically describe the organism as a blob-like entity with an inside and an outside, bounded by the skin, and interacting with the surrounding environment across the boundary. But fungi are not like that. They leak, they ooze, their boundaries are indefinable; they fill the air with their spores and infiltrate the ground with their meandering, ever-branching and ever-extending fibres. What we see above ground are merely fruiting bodies, like street-lamps which cast their aerial illumination only thanks to hidden, subterranean circuitry.

2 Q: How Did This Early Exposure to the Practices of Science of Your Father Shape Your Engagement with It?

At school, guided by inspirational teachers, I sat at the edge of my seat in wonder at the mysteries of the universe as they were being unravelled by science. I experimented with cloud chambers and grew crystals in solution. It was obvious that I was going to be a mathematician and a scientist. A year of studying natural sciences at the University of Cambridge, however, put paid my illusions. After the excitement of school science, lectures at Cambridge were an intense disappointment. I found much of what was taught intellectually claustrophobic, dedicated to the regimented and narrow-minded pursuit of objectives that seemed remote from experience. Unlike many of my fellow students, outraged by science's renunciation of its democratic principles and its surrender to the mega-machines of industrial and military power – this was, after all, a time when the war in Vietnam was at its height – I never became radically hostile to the scientific project. But I could see no future in it for myself. I wanted to study something in which there was room to grow, where I could discover the world and myself at the same time. And that was what led to anthropology. There is an enormous division in the university between the natural sciences, on the one hand, and the arts and humanities, on the other. I was looking for a subject to study that would help to bridge and transcend that division.

It seems to me that, over the course of my lifetime, science has increasingly lost its ecological bearings, while the arts have increasingly gained them. As regards the journey in my own teaching and research, I now imagine it as an Odyssey – a journey home – to the kind of science imbibed in childhood, as the son of a mycologist. This was a science grounded in tacit wonder at the exquisite beauty of the natural world, and in silent gratitude for what we owe to this world for our existence. Today's science, however, has turned wonder and gratitude into commodities. They no longer guide its practices, but are rather invoked to advertise its results. The goals of science are modelling, prediction and control. Perhaps this is why, more and more, we turn to art to rediscover the humility that science has lost? It seems to me that the people who are doing what I understood – forty years ago – to be science are now artists. Thus, my

project is now one that seeks to integrate anthropology with the practices of art, architecture and design.

3 Q: What, then, Made You an Anthropologist?

It is commonly supposed that anthropology is a centrifugal discipline that discharges its practitioners into fields as remote and far away as possible, in order that they may experience ways of life as different from their own as they could hope or expect to find. Many anthropologists would agree, flaunting their encounter with "radical alterity" as a badge of honour. But for me, it has always felt the other way around. Ever since I embarked on my studies of the subject, anthropology has been about finding my way home. I had no settled point of origin from which to start. It was not as though, even before setting out, I already knew all there was to know about myself and what I was going to be. Like most apprentice anthropologists, I did go to a relatively distant place to undertake fieldwork, and in my case this involved a prolonged stay among Skolt Saami people in the far northeast of Finland.

At the time, however, I had almost no idea of whom I was or where I came from, let alone of where I was going. I had a name and address, a passport, and next of kin to be contacted in case of emergency; I even had a degree from a respected university and a scholarship to support my work. But the voice with which I spoke, the hand with which I wrote, even the mind with which I thought – these were not yet me. They were but habits I had borrowed or styles that I had, at one time or another, sought or been trained to emulate. In that sojourn in Lapland, however, and through the moral education it gave me, I took my first, tentative steps homeward. The road has been long and tortuous. I have not arrived yet, and probably never will. But I am now more confident that it is indeed my voice that speaks, my hand that writes and my mind that thinks. With voice, hand and mind I now declare: *This is who I am*.

4 Q: How Would You like to See Your Kind of Anthropology Develop?

The way I see anthropology is that it lies at the crossroads of two divisions: one between the humanities and the natural sciences; the other between theoretical speculations about what human life could be like and empirical observation of what human life is like, somewhere, sometime. I would like to bring anthropology back to the centre, where I think it belongs, in public debates about what it means to be human, about freedom, about responsibility, about ethics. At the moment it isn't there. Instead, the ground is being occupied by psychologists, historians and economists, and what they say often perpetuates – rather than dispels – prejudice and misunderstanding. I worry that anthropology has allowed itself to fall below the horizon of public consciousness. We need much more ambition in what we do. But, in a way, the debates don't change. The fundamental questions are still: what does it actually mean to be a human being in the world; what is language all about; how is it that we perceive the way we do; how can we remember things; why do we tell stories all the time? These are basic anthropological questions.

5 Q: What Might This Mean for the Practice of Anthropology? or, More Specifically, What Might Be Entailed by an Ecological Anthropology?

The mycologist Alan Rayner once remarked to me, in passing, that the whole of biology would be different had the fungal mycelium – rather than, say, a mouse or a sea-urchin – been taken as a prototypical exemplar of the organism. Many years later, this thought would come back to haunt me - what if we were to think of the person, like the fungal mycelium, not as a blob but as a bundle of lines, or relations, along which life is lived? What if our ecology was of lines rather than of blobs? What then can we mean by "environment"? People, after all, don't live inside their bodies, as social theorists sometimes like to claim in their clichéd appeals to the notion of embodiment. Their trails are laid out in the ground, in footprints, paths and tracks, and their breaths mingle in the air. They stay alive only as long as there is a continual interchange of materials across ever-growing and ever-shedding layers of skin. Thus, just as mycology subverts deeply held intuitions in the biological sciences, so – it now seems to me – anthropology does the same for the social sciences. Anthropologists, mycologists of the social, are the awkward squad, the jesters, the fools, who sidle up to power and chip away at its pretensions. And perhaps their awkwardness lies in precisely this: that they see a world of intricately enmeshed relations rather than one already divided into discrete and autonomous entities.

In the latter years of his life, my father used to rail against the way, in his view, biological science had lost touch with the reality of living organisms. He found much of the literature incomprehensible. It was produced by modellers who had never observed or handled anything that lived or grew upon this earth, and who spent their time in laboratories or in front of computers, analysing massive datasets spewed out by machines from the stuff fed into them. In the spectacular and lavishly funded rise of e-social science we have seen much of the same. Fuelled by the digital revolution, it has become an immense data-processing exercise from which the people have effectively disappeared. In the social as in the biosciences, qualitative field-based inquiries with living people or living organisms are increasingly regarded as naïve or amateurish. It is as though science had turned its back on the living, avoiding sentient involvement of any kind. In this brave new world, life is disposable, and its forms – whether human or non-human – are mere grist to the mill of data-analytics, the purpose of which is to produce results or "outputs" whose value is to be judged by measures of impact or utility rather than by any appeal to truth.

A datum is, by definition, that which is given. But what today's scientists count as data have not been bestowed as any kind of gift or offering. To collect data, in science, is not to receive what is given but to extract what is not. Whether mined, washed up, deposited or precipitated, what is extracted comes in bits, already broken off from the currents of life, from their ebbs and flows, and from their mutual entailments. For the scientist even to admit to a relationship of give and take with the things in the world with which he deals would be enough to disqualify the inquiry and any insights arising from it. Ideally he should leave it all to his recording equipment and exit the scene, only to return to register the outcomes once the job is done and to transfer them to a databank or storage facility for safe keeping. That this is impossible in practice – especially in the

field sciences for which the laboratory is nothing less than the world we live in, and from which there is no escape – is often considered a shortcoming, a weak point in the methodological armoury that could compromise the objectivity of the results. For what is methodology, if not a shield to protect the researcher from direct sensory contact with materials? The prescriptions of methodology treat the researcher's own presence not as an essential prerequisite for learning from what the world has to offer us, but as a source of observer bias to be reduced at all cost. Any science that fails in this regard is considered to be methodologically "soft", and anthropology by that measure – and mycology too, as my father used to practise it – is positively squishy.

6 Q: So This "Squishiness" Needs to Be Celebrated and Embraced by Anthropologists?

Yes indeed! Let us compare a hard object – say a ball – with a squishy one. The first, when it comes up against other things in the world, can have an impact. It can hit them, or even break them. In the hard sciences, every hit is a datum; if you accumulate enough data, you may achieve a breakthrough. The surface of the world has yielded under the impact of your incessant blows, and having done so, yields up some of its secrets.

The squishy ball, by contrast, bends and deforms when it encounters other things, taking into itself some of their characteristics while they, in turn, bend to its pressure in accordance with their own inclinations and dispositions. The ball responds to things as they respond to it. Or in a word, it enters with things into a relation of *correspondence*. In their practices of participant observation – of joining with the people among whom they work and learning from them – anthropologists become correspondents. They take into themselves something of their hosts' ways of moving, feeling and thinking, their practical skills and modes of attention. So too, my father corresponded with the fungi as he drew their forms under the microscope. His hand, along with the pen it held, was drawn into their formative processes, and as he drew the forms re-emerged on the surface of the board. Correspondence, whether with people or with other things, is a labour of love, of giving back what we owe to the human and non-human beings with which and with whom we share our world, for our own existence and formation.

Two centuries ago, in Germany, Johan Wolfgang von Goethe proposed a method of science which demanded of practitioners that they should spend time with the objects of their attention, observe closely and with all their senses, draw what they observed, and endeavour to reach a level of mutual involvement or coupling, in perception and action, such that observer and observed become all but indistinguishable. It is from this crucible of mutual involvement, Goethe argued, that all knowledge grows.

7 Q: What Became of Goethe's Vision – This Notion of a Sensual and Involved Science?

I have a strong suspicion that the virulent repudiation of what we could call the *science of correspondence* coincides in a way that is not accidental with the colossal expansion,

over the last four decades, of globalization and the political economy of neoliberalism. These, of course, were the decades of my career as a professional anthropologist. What I have witnessed, over these decades, is the surrender of science to the forces of neoliberalism. And to find a counter-movement in the contemporary world, we have to turn not to science but to art.

8 Q: So Anthropology Might Be Understood as a Form of Art?

What might pejoratively be regarded as squishy science could, I think, be better and more positively described as the *art of inquiry*. In this art, every work is an experiment: not in the natural scientific sense of testing a preconceived hypothesis or of engineering a confrontation between ideas "in the head" and facts "on the ground", but in the sense of prising an opening and following where it leads. You try things out and see what happens. Thus the art of inquiry moves forward in real time along with the lives of those who are touched by it, and with the world to which both it and they belong. Far from matching up to their plans and predictions, it joins with them in their hopes and dreams. This is the very opposite of methodology.

It is not to wrap method up into an impregnable shell, protecting the investigator from having to share in the suffering of those subjected to his hard-ball tactics, but rather to compare method to a way of working, akin to a craft, which opens up the world to our perception, to what is going on there, so that we in turn can answer to it. We could call it the *method of hope*: the hope that by paying attention to the beings and things with which we deal, they in turn will attend to us, and respond to our overtures. Anthropology, I believe, can be an art of inquiry in this sense. We need it not to accumulate more and more data about the world, but to better correspond with it.

9 Q: How Does This View Square with Traditional Conceptions of the Anthropological Project?

This is not the way in which most practising anthropologists currently think about their discipline. The majority of my colleagues would insist that the primary task of the anthropologist is ethnographic: that is, to give a richly detailed, accurate and nuanced account of life as it is lived for particular peoples in particular times and places. There is absolutely nothing wrong with this, of course, just as there is nothing wrong with a history of art that looks back on how artworks have been made and received, again in specific times and places. For ethnography as for the history of art, understanding is about putting things in context. Yet for all its manifest scholarly virtues, to put things in context is also to lay them to rest, to silence them or neutralize their power, so that the things themselves cease to engage our attention as active and ongoing forces in the world. They are, so to speak, accounted for, ticked off, put in their place. But people don't act, nor do artists work, in order that their deeds and works may be accounted for by future historians. They act and work in order to make a difference in the world. Thus to create a work of art is to give birth to a new being, a being that will have its own life,

alongside the lives of those who touch and are touched by it. The thing springs up, and like a rebellious child, refuses the efforts of its elders to put it to bed.

Anthropology, for me, is not about describing the world, or wrapping it up. It is, in the first place, about attending to presence, about noticing, and responding in kind. It means acknowledging that persons and other things are there, that they have their own being and their own lives to lead, and that it behoves us, for our own good, to pay attention to their existence and to what they are telling us. Only then can we learn. The same, I think, might be said for art. It too is an opening on the world rather than an attempt at closure – an opening that exposes the practitioner to its trials and to its gifts. That is why art combines well with anthropology but not with ethnography. For what art and anthropology open up, ethnography – like art history – seeks to contain.

10 Q: Is This Notion of Anthropology as Art Likely to Be Dismissed as "Unscientific" Within the Contemporary Academic World?

Very probably. I remember the science of my childhood, grounded in tacit wonder at the exquisite beauty of the natural world, in care, attentiveness and in silent gratitude for what we owe the world for our existence. Much of today's science, however, has turned wonder and gratitude into commodities. They no longer guide its practices but are rather invoked to advertise its results. Science has even enlisted art to promote its hard-sell, to offer images that beautify its results, soften its impact and mask its collusion with corporations whose only interest in research is that it should "drive innovation". For in the neoliberal economy of knowledge, only what is new sells. True, much scientific research, in what is nowadays known as "academia", lacks immediate application. It is said to be curiosity-driven or "blue sky". Scientists have been vociferous in defending their right to undertake blue-sky research. But in the land of academia, curiosity has been divorced from care, freedom from responsibility. Academia's income comes from its exports of knowledge, but it is left to those who buy the knowledge to determine how it should be applied, whether to build bombs, cure disease or rig markets. Why should scientists care? This attitude reveals the lofty appeal to blue skies to be little more than a self-serving defence of special interests increasingly concentrated in the hands of a global scientific elite which, in collusion with the corporations it serves, treats the rest of the world – including the vast majority of its increasingly impoverished and apparently disposable human population – as a standing reserve of data to feed the insatiable appetite of the knowledge economy.

We should care, of course, because truth matters. And the responsible search for truth demands that care and curiosity go together. They are really two sides of the same coin. We are curious about the well-being of people we know and love, and never miss an opportunity to ask them how they are doing. That is because we care about them. Should it not be the same for the world around us? Is not curiosity a way of caring? Not, it must be said, according to the protocols of normal science which require, in the name of objectivity, that we sever all personal relations with the things we study, and remain unmoved and unperturbed by their condition. We owe them nothing, according to these protocols, and they offer us nothing in return.

It is a great mistake, however, to equate the pursuit of objectivity with the pursuit of truth. For if the former prescribes that we cut all ties with the world, the latter demands our full and unqualified participation. I may be being childish or naïve, but in my innocence I still believe in science as the pursuit not of innovation but of truth. And by truth I do not mean fact rather than fantasy, but the unison of experience and imagination in a world to which we are alive and that is alive to us. It is a truth that comes not after science, in its proud record of discoveries and achievements, but before science, in the more humble recognition that we are ourselves beholden, for our very existence, to the world we seek to know. Thus the movement from science to art, in my thinking and in my teaching, did not take me further away from science but further into it, into the very conditions of its possibility. I have gone from science to art and back again.

11 Q: We Typically Conceive of the Social and Natural Worlds as Separate, but You Have Been Very Keen to Get Beyond Any Such Dichotomy. What Would It Mean to Think Beyond Our Conventional Distinctions Between Cultural and Natural Phenomena?

Sociocultural anthropology established itself as an independent sub-discipline by designating the social and cultural as a specific domain of study, allowing it to distance itself from certain retrograde positions found within the domain of physical anthropology. However, the nature/culture dichotomy on which this division was based has been the object of sustained criticism. The challenge for our discipline is to define an anthropology beyond nature and culture.

12 Q: But What Does This Imply for the Way We Think About Being Human in the World?

I contend that person and organism are one and the same; the organism-in-its-environment is a being-in-the-world. To follow this through requires a completely different kind of thinking, one that starts not from populations of individuals but from fields of relations. We need to integrate the social and the biological – to seek to better understand persons-organisms as "biosocial becomings".

13 Q: So Developing a New Conceptual Vocabulary Would Seem to Be Very Important. the Notion of Attending to "Biosocial Becomings" Is Intriguing – the Emphasis on Movement and Becoming Is Clear, but Are You Advocating Some Form of Sociobiology?

Absolutely not! One has to be careful with how one uses the term "biological". We should reject neo-Darwinian forms of naturalist epistemology that attempt to interpret

the evolution of culture by establishing an analogy between genes and memes. This kind of reductionistic view of evolution is extremely dangerous. Evolution does not lie in the mutation, recombination, replication and selection of transmissible traits. It is rather a life process. And at the heart of this process is *ontogenesis*.

My aim is to restore the person to the continuum of organic life – not in the reductionist fashion of sociobiology, by putting it all down to genes, but by repositioning the organism as a locus of growth within a continuous field, and by thinking of evolution not statistically but topologically, as the unfolding of that field. Life is not in organisms; rather organisms are in life. Or in other words, living things are both generated and held in place within the ever-unfolding matrix of relations to which they contribute in their activity. This means giving a central place to growth and development in the constitution of life-forms.

14 Q: Is This Why You Are so Adamant in Your Dismissal of Hylomorphism?

Yes. In my 2013 work, *Making*, I attack the hylomorphism that is at the heart of the Neo-Darwinian view - the notion that the form of an organism is something already determined before its actual development. The fallacy of this way of thinking lies in supposing that the form miraculously precedes the processes that give rise to it. And the way to overcome the fallacy is simply to reverse the order, so as to give primacy to the process of ontogenesis – to the fluxes and flows of material entailed in making and growing – over the forms that arise within them.

For me, there are no objects. I see a world in the making, not a world already made. Making things is not an imposition of form on matter, as though the end were already settled before the task began. For how can form precede the processes that give rise to it? How can a known and determined future precede the present and the past? In my childish eyes, not knowing what the future holds, making is a never-ending task of world-weaving, a correspondence of material movement and ambient vision.

15 Q: Ontogenesis as a Lively Process of Making and Growing, Which Involves Flows of Material … How Does All This Relate to Conventional Ecological Conceptions of the Relationship Between Organisms and Their Environment?

We are all, and have always been, organism-persons. But these organism-persons should not be thought of as bounded entities but as sites of binding, formed of knotted trails whose loose ends spread in all directions, tangling with other trails in other knots to form an ever-extending meshwork. As I have already described, this description of the organism-person would serve just as well for the fungal mycelium.

And for this reason I have come to question what we mean by "the environment", and eventually to see it not as what surrounds – what is "out there" rather than "in here" – but as a *zone of interpenetration* in which our own and others' lives are comprehensively

entangled. Within this zone, organisms grow to take on the forms they do, incorporating into themselves the lifelines of other organisms as they do so. Every organism is a site of infestation, a vast ecosystem in itself.

16 Q: This Emphasis on Entanglement and Growth Suggests a Very Active Role for Organism-Persons in Producing Their "Environments"?

Yes. This puts paid, once and for all, to the idea, still earnestly promulgated by many biologists and psychologists, that the child is a product of "nature" and "nurture", or of the interaction of genes and environment, in varying and often contested proportions. For children are not products, period. They are the producers of their lives with others, including grown-ups.

All knowledge is founded in skill, in the improvisatory exploration of ways of doing things, under the watchful eye of more experienced hands. This is how children learn: not through having knowledge first socially transmitted to them, and then enacting in practice what they each have individually acquired, but by growing in knowledge, as they do in strength and stature, by following the same paths as their predecessors and under their direction. It is a process, if you will, of guided rediscovery, in which every generation stands to find out for itself much of what its forbears already knew, and possibly much else besides. Learning, as children know very well but as their teachers so often do not, is a creative process in which knowledge is not so much passed on as perpetually grown and regrown. And if people differ in what or how they know, it is not because they have inherited different "packages" of transmitted representations, but because their lives have been entangled in environments, and in communities of practice, that differ in what they afford, in the kinds of attention they demand, and the responses that these demands call forth. Skill, in essence, inheres in the coordination of perception and action, attention and response. What we are used to calling cultural variation, then, consists in the first place in variations of skill. And to account for this variation we have to attend not to the content of inherited tradition but to the dynamics of ontogenetic development.

17 Q: So the Emphasis Is on the Porousness of Boundaries Between the Human and Non-human, Organism and Environment, and on Their Mutual Interpenetration?

Yes – the domain of the social and the biological are one and the same. The person is not so much a creature of society as an active and ongoing creator of his or her own and others' selves. In the new language of relationality, person-selves are seen as mutually constitutive.

Therefore, we must think of human beings in terms not of what they are but what they do. If we imagine life as a "line of becoming" it appears that cultural forms arise within the weave of life, in conjoint activity. That being the case, we must think of evolution not as change along lines of descent but as the developmental unfolding of

the entire matrix of relations within which forms of life (human and non-human) emerge and are held in place. And it requires us to think of these forms as neither genetically nor culturally configured but as emergent outcomes of the dynamic self-organization of developmental systems.

18 Q: If We Problematize the Common Distinction Between the "Natural" and the "Artificial", What Are the Implications for How We Should Conceive of Activities like Designing and Building?

I don't think, in the end, that we can sustain this division between the natural and the artificial, and it is probably not helpful to do so. But that also means, perhaps, substituting the word growing for building, because building always has this thing that you're putting something in place, whereas, growing gives the sense of a process going on under certain conditions. So, when a gardener says: "I'm growing these plants in my garden", it means that he is planting the seeds, putting in place certain conditions to favour the growth of those particular plants. But, still, other things are involved for the plant to grow. The gardener is not building it, in that sense.

The same argument you could make about the growth of a forest, you could also make about the growth of those kinds of structures that we tend to call artificial, like houses, or roads and the like. Can we think of these things as also grown, in the sense that the structure emerges out of a set of practices or processes? Some of these practices and processes might be undertaken by humans, and maybe in building a house, most of them are. But, still, other things always come in, houses have other animal inhabitants; then there is the weather, of course, and the sun, the rain and all sorts of other things with which you have to contend. So, the idea that a house is first built and then people come to live in it is, to some extent, part of an architectural conceit. It doesn't really match what actually happens.

So, rather than asking: "Do we have a division between natural and artificial?", I prefer to say that we are looking at processes by which the structures that we find in the world have grown. And, what are the conditions for growth? What has been the role of local communities in creating these conditions? And then we can ask: "What has been the role of the birds, what has been the role of the weather and everything else that has combined to create something?"

19 Q: Let Us Shift Now to a Terrain that Might Be More Familiar to an IS/OS Readership. in Your Work, You Have Famously Criticized Bruno Latour and Actor-Network Theory. but, for Us, You Seem to Have so Much in Common?

There are many parallels between the conclusions that I arrive at and the conclusions that Latour arrives at. We are both destabilizing the dichotomy between Society and Nature, we are both thinking in terms of whether a network is the same as a meshwork

or different. It depends on which page of Latour you happen to be reading, because he moves backwards and forwards. There are many points and areas where there is similarity, but we come from different places and that accounts for some of the differences.

I have several objections to Latour, but I particularly object to his blanket use of the non-human – a theory that attributes the same ontological weight to a speed bump or a gun or a key as is given to a living creature gives us a seriously reductionist view of what life is. I don't see how you can invoke a principle of symmetry. For instance, in the case of a grain of sand and a mite, they might weigh the same, but we are dealing with something fundamentally different, and that difference then is bound up for me with a focus on developmental processes that I think is crucial. Developmental processes, processes of growth, maturation, decay and decomposition, are fundamental to what I understand by life. I think that simply talking about anything as an actant loses that sense of what life is and I don't find a sense of what life is in Latour, not what I understand it to be, anyway.

Of course, Latour is taken in all sorts of different directions and many of them are directions that he himself would want to disown. Thus Latour's point is often taken to be that non-humans can have agency. But it's not as simple as that. In fact it is quite difficult to criticize Latour because, whichever way you cut it, you end up with a particular caricature of what he says. And this is because he is always changing what he says, or else saying what he said before while meaning something else. I shouldn't object to that because I change what I say, too. But I do find that at one moment he is saying that actor-network isn't a theory and is not actually about networks and at the next moment he's saying that actually it is a theory and it is about networks. This inconsistency creates some difficulties for me.

I would define life as the name for what is going on in the field of relationships within which organic forms emerge, develop and are held in place – that is what I understand as a life process. And I don't find that in Latour's understanding of the actor-network. I think, if you reduce life to agency and things to objects you effect a double reduction.

20 Q: You Mentioned Earlier the Importance of the Idea of Lines in Your Work. What Are These Lines? or, What Is It that the Image of Lines Wants to Convey?

For me lines are about life, in the sense of lifelines. Lines imply movement and growth. Ways of moving, knowing and describing. They are lines of force, of growth and of movement, not outlines. Outlines enclose. Minds and lives are not closed-in entities that can be enumerated and added up; they are open-ended processes whose most outstanding characteristic is that they carry on.

21 Q: But Are Lines then These Lone Travellers that just Carry on …?

No, in carrying on, they wrap around one another, like the many strands of a rope. A whole that is made up from individual parts is a totality in which everything is articulated or "joined up". But the rope is always weaving, always in process and – like social life itself – never finished. Its parts are not elementary components but ever-extending lines, and its harmonies reside in the way each strand, as it issues forth, coils around the others and is coiled in its turn, in a countervalence of equal and opposite twists which hold it together and prevent it from unravelling. This interweaving of lines I call a meshwork – the trails along which life is lived. It is in the entanglement of lines, not in the connecting of points, that the mesh is constituted. A meshwork, in which every node is a knot. Indeed, I would suggest that in a world where things are continually coming into being through processes of growth and movement – that is, in a world of life – knotting is the fundamental principle of coherence.

22 Q: That Is Interesting. What Do You Want to Convey with This Idea of a Knot or Knotting?

Well, I will first say what knotting is not. The knot is not a building block. Blocks are assembled into structures; knots are bound or tied into nodes or nodules. Thus the order of the block is explicate, in that each is joined to the other by external contact or adjacency; the order of the knot is implicate, in that the constitutive strands of each knot, as they extend beyond it, are bound into others. Further, the knot is not a chain. Chains are articulated from rigid elements or links, and retain their connections even when tension is released. Yet they have no memory of their formation. Knots, by contrast, are not articulated and do not connect. They have no links. Nevertheless they retain within their constitution a memory of the process of their formation. The knot is not a container. Containers have insides and outsides; in the topology of the knot, however, it is impossible to say what is inside or outside. Rather, knots have interstices. Their surfaces do not enclose but lie "between the lines" of the materials that make them up.

23 Q: So Knotting Is a Way of Joining, of Being with, but that Is Very Different from Connecting …?

Yes, lines of life do not connect. They do not go from A to B, or vice versa. Rather, they pass between points without connecting, as the waters of a flowing river pass between its banks. It is the same in music or in painting. Whether it be the issue of the melody from the meeting of violin and bow or the motion of the brush and its trace, in the movement of becoming, points are not joined so much as swept aside and rendered indiscernible by the current as it sweeps through. Life is open-ended: its impulse is not to reach a terminus but to keep on going. In the meshwork, each constituent line, as it bodies forth, lays its own trail from within the interstices of its binding with others. Thus the joining of lives is also their continual differentiation. The knots formed in the process

are not inclusive or encompassing, not wrapped up in themselves, but always in the midst of things, while their ends are on the loose, rooting for other lines to join with.

24 Q: In One of Your Papers You Make the Distinction Between Joining "up" and Joining "with", Is This What You Have in Mind Here?

Yes. The adverb "up" connotes a finality that is belied by the ongoing life of the thing. It is no more joined up than used up. On the contrary, it carries on. In the meshwork, lines are joined not "up" but "with". Like the voices of choral music, whose harmony lies in their alternating tension and resolution, the entwined lines of the meshwork join with one another, and in so doing, possess an inner feel for each other and are not simply linked by external contiguity. I use the term sympathy to refer to this feel.

25 Q: Is This Notion of *Sympathy* Where Your Idea of Correspondence Comes in?

For me correspondence is the co-responsive movement of occurrent things along their manifold *lines of becoming*. Maxine Sheets-Johnstone argues we must recognize that the key to both self-knowledge and organic life is movement. It is not just that bodies, as living organisms, move. They *are* their movements. Therefore, the knowledge they can have of themselves is inseparable from the sense they have of their own movements, or in a word, from kinesthesia. Animate beings, Sheets-Johnstone insists, do not experience themselves and one another as "packaged" but as moving and moved, in ongoing response – that is in correspondence – *with* the things around them.

In his reflections on upbringing in *The Troubadour of Knowledge*, Michel Serres compares this experience of being in-between – of correspondence – to that of the swimmer, breasting the current of a swift river. Here in the midstream, you enter a world unknown to those left standing on the banks. It is one in which, after a while, there is no longer any right bank or left bank, where you cease to be between this and that, where you have become a hyphen, a denizen of the in-between. Immersed in a fluid medium, always at risk of going under, you have no option but to keep on going, in a direction orthogonal to that of the line connecting the banks on either side. "The real passage", as Serres declares, "occurs in the middle". This goes to the heart of the distinction I want to draw between correspondence and interaction. Interaction goes back and forth as agents, facing each other on opposite banks of the river, trade messages, missiles and merchandise. But to correspond, in my terms, is to join with the swimmer in the midstream. It is a matter not of taking sides but of going along. Thus where interaction is transverse, correspondence is longitudinal.

Correspondence is not a connection of points but a binding of lines. It is not interactive but multilinear. And these lines, as we have seen, join not at the ends but in the middle. Ends are not given in advance but emerge in the action itself, and are recognizable as such only in acknowledging the possibility of new beginnings. Here, beginnings

produce endings, and are produced by them. Every end is not a terminal but a moment along the way. Thus for the interaction of subjects, or intersubjectivity, I substitute the correspondences of the middle voice, and for the network of connected points, the meshwork of knotted and entangled lines.

26 Q: We Have Explored a Number of Ideas. Maybe We Can Conclude. Given Our Conversation, What Would You Say to Information Systems and Organization Studies Researchers, in Terms of How They Approach What They Do?

I would say that the world that they study is alive and open. In a world that is truly open there are no objects as such. For the object, having closed in on itself, has turned its back on the world, cutting itself off from the paths along which it came into being, and presenting only its congealed, outer surfaces for inspection. The open world, however, has no insides or outsides, only comings and goings. Such productive movements may generate formations, swellings, growths, protuberances and occurrences, but not objects. Our natural tendency, our habit of thought, leads us to suppose that the world is inhabited by entities that are already closed in upon themselves. It prevents us from seeing that life can be anything other than an interior property of things. Conceived as the creative potential of a world-in-formation, however, life is not in things; rather, things are in life, caught up in a current of continual generation. This is not a matter of putting life into things but of restoring those things to the movements that gave rise to them. It is not that they have agency, as is sometimes claimed; they *are* agency. The wind is its blowing, not a thing that blows.

Our "as if" world of science, the world of objects and relations, is *explicate*. The order of the social world, by contrast, is *implicate*. That is to say, any particular phenomenon on which we may choose to focus our attention enfolds within its constitution the totality of relations of which, in their unfolding, it is the momentary outcome. Were we to cut these relations, and seek to recover the whole from its now isolated fragments, something would be lost that could never be recovered. That something is *life itself*.

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This interview has grown through the interpenetration of a range of different sources. Most notably, these include the following

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Doing Process Research

From Substantialist to Process Metaphysics – Exploring Shifts in IS Research

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Abstract. This article examines the shifts in Information Systems (IS) research from a positivist to interpretive to sociomaterial paradigm by demonstrating how the shifts reflected the move from substantialist towards process metaphysics. Such metaphysical grounding provides a foundation for deeper understanding of paradigm differences and the struggles when shifts occur. After a brief historical overview of substantialist and process metaphysics and a summary of their key assumptions, the article explores paradigm shifts in IS research and highlights the underlying metaphysical nature of surrounding difficulties and controversies. The article advances the paradigm debate by drawing attention to the metaphysical nature of paradigmatic shifts in IS research and by opening up intellectual space for conceiving and understanding novel research approaches beyond Burrell and Morgan's model [1].

Keywords: Substantialist metaphysics · Process metaphysics · IS research · Positivist paradigm · Interpretive paradigm · Sociomaterial paradigm · Paradigm debate

> Labels in philosophy and cultural discourse have the character that Derrida ascribes to Plato's pharmakon: they can poison and kill, and they can remedy and cure. We need them to help identify a style, a temperament, a set of common concerns and emphases, or a vision that has determinate shape. But we must also be wary of the ways in which they can blind us or can reify what is fluid and changing.
>
> Richard J. Bernstein

1 Introduction

Metaphysics is the branch of philosophy broadly defined as the study of the nature of being, traditionally concerned with basic questions: What is there? and What is it like? [2, 3]. The task of metaphysics is to clarify fundamental notions of existence, entities and processes, space and time, mind and matter, and to articulate a conceptual framework for understanding the world and grounding human knowledge [4]. Metaphysical assumptions thus provide a foundation, a worldview, that enables seeing, understanding and investigating the world, anything that exists. A consistent set of metaphysical assumptions is called a paradigm [1, 5, 6]. Any research inquiry is grounded in a particular worldview, a paradigm, that legitimizes and limits what is

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researched, the nature of knowledge and the ways research is conducted and knowledge claims created.

Classification of paradigms by Burrell and Morgan [1] represents a significant milestone that changed scholarly discourse in social sciences by defining the metaphysical assumptions underpinning major paradigms, namely the functionalist (positivist), interpretive, radical humanist and radical structuralist. Burrell and Morgan's model of paradigms had an enormous impact on social sciences, including organization studies and Information Systems (IS), primarily because it recognized non-functionalist (that is, non-positivist) paradigms while at the same time protected the dominant functionalist (positivist) paradigm from raising criticism [7]. The model, however, has also had some unintended implications: its use tended to reify the rigid notion of paradigms and its dimensions of differentiation (objective vs subjective; regulation vs radical change) obscured "important differences in current research orientations and lead to poorly formed conflicts and discussions" [7] (p. 191). The paradigms (*labels*) that meant to focus attention and *cure* have been increasingly used to fix and police borders and fight paradigm wars, thus limiting rather than enhancing research opportunities.

The IS discipline followed these developments in social sciences albeit with some delays. A study of publications in the key IS journals in the 1980s by Orlikowski and Baroudi [8] found that 96.8% of empirical papers adopted a positivist paradigm. The landmark 1984 Manchester Working Conference [9] alerted the IS community to these developments in social sciences and opened up new research approaches and opportunities. However, in their study of publications during the 1990s in a larger set of IS outlets Chen and Hirschheim [10] found that positivist research continued to dominate (adopted by 81% of empirical papers). While they welcomed the decreasing dominance of positivist research, Chen and Hirschheim called for renewed efforts by interpretive researchers and the change of editorial policies [10].

Since then the IS research landscape has significantly changed. The increasingly digitized, networked and global world and the new phenomena emerging with ubiquitous, pervasive and embedded information, communication and mobile technologies, have radically transformed the landscape and texture of the contemporary IS problematic (see e.g. [11–15]). The range and complexity of IS problems are increasing beyond the IS discipline's ability to imagine and examine. Researchers are therefore pushing for expansion of intellectual boundaries by exploring new research opportunities and proposing new research approaches [16–22].

While the interpretive paradigm increased prominence and acquired legitimacy [23, 24] its metaphysical assumptions limited researchers' ability to deal with the emerging IS phenomena. Framed in opposition to positivism the interpretive paradigm remained within the confines of the Burrell and Morgan model [1]. Both have been critiqued for their failure to account for the complexity and uncertainty of contemporary IS phenomena and in particular the puzzling and fluid entanglement of the social and the technological [16, 18, 21, 25–29]. A radically novel sociomaterial approach has been proposed that, in simple terms, assumes an ever-changing world that is continuously re-constructed and re-assembled out of heterogeneous materials [16, 18]. While the sociomaterial approach drew the imagination of IS and organization studies scholars, its distinct nature has been questioned (e.g. [25, 30]) and its assumptions

considered wrong (e.g. [27]). The debate on sociomateriality has obscured rather than revealed important distinctions, leading to poorly grounded and misleading conflicts.

What is particularly striking is that the recent paradigm debate could no longer be productively grounded in Burrell and Morgan's paradigm model [1] because the relevance of its dimensions of differentiation has progressively diminished [7, 31]. Grounded in the metaphysical separation of the subject and the object, the "subjective-objective" dimension "reproduces a neo-positivist philosophy of science and obscures the nature of other research programs" [7] (p. 194). The "subjective-objective" dimension has thus become progressively "eroded" [31] (p. 261) while the "regulation-radical change" dimension has been compromised [7]. We therefore need not only new paradigms but also and importantly a different metaphysical grounding to allow for emerging paradigms and for understanding new distinctions among paradigms – distinctions that would enrich and stimulate the paradigm debate and help the IS discipline produce significant and relevant scholarship.

In light of the above discussion, my aim in this paper is (i) to propose an alternative metaphysical distinction – that between substantialist and process metaphysics – as a potentially useful grounding for understanding different paradigms and (ii) to show how such metaphysical grounding enables new insights into differences among research paradigms and thereby contributes to the contemporary IS paradigm debate.

To achieve these aims and put the debate in a historical context, I first present a brief historical overview of substantialist and process metaphysics and then propose a comparative review of their key assumptions. This is followed by the analysis of paradigmatic shifts in IS research – from positivist to interpretive to sociomaterial research approaches – grounded in differences among the substantialist and process metaphysics. The paper advances the paradigm debate by drawing attention to a metaphysical nature of paradigmatic shifts in IS research and by opening up intellectual space for conceiving and understanding novel research approaches beyond the Burrell and Morgan model [1]. The paper concludes with suggestions for expanding this debate further.

2 Historical Roots of Substantialist and Process Metaphysics

The controversial question about the nature of reality that we are currently struggling with is much older than we typically acknowledge. Whether the reality consists of substances (defined by bundles of properties) or processes is indeed a perennial question, vigorously debated since antiquity. As philosophers throughout the history of thought have attempted to deal with and explain experiences of permanence and change, they have argued opposing positions by giving primacy to either Being or Becoming.

Heraclitus (born ca. 560 BC) stands out as the first philosopher of Becoming, who argued that the world is in constant and ubiquitous flux and that everything is always flowing in some respects [32]. Considered the founder of the process philosophy [33, 34], Heraclitus opposed the view that substances are fundamental constituents of the world and posited that the world consists of constant metaphysical flux ("an ever living fire"). He thus considered processes ontologically primary and substances secondary. His

metaphysics of constant flux (attributed to Heraclitus by Aristotle and Plato) was famously illustrated by the expression that it is not possible to step into the same river twice. While the river in everyday usage is assumed to be the "same river" whenever we step into it, the river is constituted of constant flow and keeps changing even while we step in. River thus cannot be seen as an object or thing but as a continuous flow. Heraclitus' metaphysics of constant flux provided a foundation for processual thinking and became seminal in the history of Western process philosophy.

Heraclitus' worldview as perpetual change and becoming stands in stark contrast to Parmenides, Leucippus and Democritus' worldview of fixed entities (subjects, objects, things), that is *pure being* as the underlying reality. The struggle between the two worldviews, that is, between the primacy of Becoming or Being, was first articulated by Plato [35]. He agreed with the Heraclitus' view that the perceptible world of ordinary experiences is processual but argued that this world is less real, being only a reflection of the world of Forms. For Plato it is Forms that really exist and particular physical objects get real when they participate in the Forms. Plato thus established the primacy of Being as the eternally unchanging Forms in contrast to Heraclitus' primacy of Becoming and the metaphysics of constant flux.

Aristotle (384–322 BC) rejected Plato's conceptions of the two worlds and argued that our natural world is real. Aristotle followed Heraclitus claiming that physical objects or matters are constantly changing, and that substances are generated as matter takes on form [36]. While substances are central to Aristotle's metaphysics it also included potency, activity (energeia), motion (kinesis) and change as fundamental categories. Aristotle's metaphysics was thus interpreted as both a foundation for substantialist metaphysics, and also an important contributor to process metaphysics.

Since antiquity, the struggle for the primacy between Being and Becoming subsided for quite some time only to be revived by Descartes (1596–1650), the "father of modern philosophy". According to Descartes, the world is composed of substances that are either mental or physical but share some common features. Mesle summarizes Descartes' substantialist assumptions as follows [33] (p. 44):

1. Substances exist independently of other substances. Descartes wrote, "By substance, we can understand nothing else than a thing which so exists that it needs no other thing in order to exist."
2. Substances are also those unchanging realities that stand under (hence sub/stance) their qualities and endure unchanged through the changes of those qualities.

Descartes' famous "mind–body dualism" implied an essential distinction and an interdependent existence of the mind (or soul, a thinking) and the body (an extended, non-thinking thing). This dualism enabled him to articulate on the one hand, a rational basis for the soul's immortality and on the other, formulate a theory of nature as the mechanistic physics that excluded the mind and mentality. Descartes's substantialist metaphysics has had a long lasting influence on Western thought and provided a foundation for the subsequent development of the "scientific method".

A significant rebirth of process thought happened at the end of the 18th and early 19th century with important contributions by German philosophers Fichte (1762–1814), Schelling (1775–1854) and Hegel (1770–1831). In response to Kant's "transcendental idealism", Fichte, Schelling and Hegel drew attention to the processual

nature of the "transcendental subject" and focused on the process by which knowable appearances are generated. For Hegel anything that exists is never stable but instead constantly changing through a dialectic process of conflicting opposites that form an inherently unstable whole.

The confrontation of substantialist and process metaphysics continued particularly vigorously in late 19th and 20th century. An alternative approach to Hegel's dialectical view of reality articulated by Whitehead's (1861–1947) speculative process metaphysics describes the world consisting of entities as "actual occasions":

> "Actual entities" – also termed "actual occasions" – are the final real thing of which the world is made up. There is no going behind entities to find anything more real. They differ among themselves [in their importance and diversity of functions] … yet in the principles which actuality exemplifies all are on the same level. The final acts are, all alike, actual entities; and these actual entities are drops of experience, complex and interdependent. [37] (p. 18)

Whitehead rejected the various dualisms, what he called the "bifurcation of nature". For Whitehead the world is composed of the *becoming* and *perishing* as relational processes – complexes of actual experiences that are produced by occasions. Actual entities are events that are created of past actual entities or in Whitehead's words they prehend previous entities. Whitehead named the concrete process of becoming of an actual entity "concrescence". These analytical concepts are key to understanding Whitehead's innovative process metaphysics which assumes that "temporal occasions of experience actively constitute one another in the flow of time, … where the force of his complex theoretical scheme becomes apparent" [38] (p. 8).

Whitehead's contemporaries James (1842–1910) and Dewey (1859–1952) developed a process-based pragmatic metaphysics. Similar to other pragmatists both James and Dewey rejected many Cartesian dualisms. Dewey and Bentley for instance wrote: "What have been completely divided in philosophical discourse into man and world, inner and outer, self and not-self, subject and object, individual and social, private and public, etc., are in actuality parties in life-transactions" [39] (p. 248). Central to Dewey's philosophy is *experience* as part of the interaction with environment, "the dynamic participation, the continuing process of an organism's adjustment not simply to environing conditions but within a biological (physical) and cultural environment" [40] (p. 9). Through such interaction and participation humans acquire meaning, determine situations that occur, engage in cooperative behaviour and actualize their potentialities.

Continuing exploration of phenomenal experience, but within the tradition of continental philosophy, Bergson (1859–1941) considered that the processual character of being was outside of human cognitive reach. Seibt [34] explained Bergson's view: "when we carefully attend to what we take in during conscious experience and who we are, without forcing a conceptualization of that experiential content or the act of experience, we find not a relation and ready-made relata but an interactivity or ongoing interfacing with the world". Referring to "beings entangled with the world" Bergson emphasized an immediate experience that allowed humans to intuitively capture the dynamics of becoming and the flow of duration ("durée"). Bergson used durée to express the notion of "real time" that is experienced rather than measured [41] which, as Linstead [42] explains, makes a distinct contribution to process metaphysics:

> spatialized time is time stripped of its intrinsic heterogeneity … [which] is essential to deterministic approaches to experience … [that assumes] life unfurls along its prescribed path according to the laws of nature. But for Bergson duration is definitely creative. Every emerging instant is new, unique, and novel. … Past, present, and future as memory, experience, and anticipation form duration where the real and the virtual meet. [42] (p. 5)

As this brief and inevitably limited review shows, process thought and process metaphysics have developed in opposition to substantialist metaphysics (vice versa is true as well) since antiquity and disputes are far from being settled. The revival of process thought in the last century, inspired in particular by developments in physics, was fuelled in the last 20–30 years by technological developments and transformative processes in society and the economy. This review shows the rich tapestry of process thinking and a broad variety of process philosophies. As Rescher puts it, "the unity of process philosophy is not doctrinal but thematic" [43] (p. 45). Indeed, we can see that they all share commitment to the primacy of Becoming over Being and the processual understanding of the world. These philosophers, as Helin and colleagues explain, "work from within things, staying with them, suspicious of abstracting too far into hierarchies of being; they stick with things and experience of things, rather than reaching into a more certain, stable and invariant world of ideas" [44] (p. 3).

3 Key Assumptions: A Comparative View of Substantialist and Process Metaphysics

From Plato and Aristotle to Descartes and onwards the world is seen as composed of substances, self-contained entities that exist independently of other substances. Substances are described by qualities or properties that may and do change while they (substances) persist and remain unchanged. Descartes' wax argument illustrates substantialist ontology and its logic [45]. A piece of solid white wax is described by its particular shape, size, colour, consistency, weight and scent, that is, by its specific properties [45]. When the piece of wax melts and becomes liquid it loses all its properties that initially distinguished it from other entities. However, Descartes explains, due to our mind and our intellectual abilities, we still believe this is the same wax implying that the substance of wax remains the same, despite the change of its specific properties. If we imagine, as Mesle does, that the world is destroyed this piece of wax would still exist in the empty space as it does not need anything else to exist [33] (pp. 44–45).

The wax example shows another important connection: between the substance-property worldview and the subject-predicate structure of language. Sentences such as "the wax is white", "the wax is hard" or "the wax smells like honey" describe the subject "the wax" and its properties or qualities. The subject (the wax) persists and is considered the same while predicates (properties) change. The wax exists independently of its properties, and thus remains unchanged when these properties change. The common sense of our cultural heritage implies that the grammatical structure – the subject and its predicates – corresponds to the structure of reality [33, 37]. Such a view of reality, as Whitehead comments, "expresses a useful abstract for many purposes of life. But whenever we try to use it as a fundamental statement of the nature

of things, it proves itself mistaken. … But it has had one success: it has entrenched itself in language, in Aristotelian logic, and in metaphysics" [37] (p. 79).

Process metaphysics has been proposed in opposition to and by contesting substantialist metaphysics throughout history.[1] First it is the founding notion of a thing, an entity or a subject defined by its properties/attributes/qualities that was contested. Responding to the wax argument and also to the view of persistent subject, mind, self, body or personality, defined by particular qualities (physical or mental) Mesle argued:

> if you take away all of those qualities, there is simply nothing left. You are a bundle of qualities, and a dynamic, changing bundle at that. Some qualities in the bundle are more persistent than others, but there is no unchanging "self", no mental substance that endures unchanged through the changes of qualities or that exists independently of those qualities so as to remain if they were all taken away. [33] (p. 47)

Mesle rejects the idea of an unchanging self or a mental substance that endures. While he admits that there is a bundle of dynamic qualities that can describe "self", together with Whitehead he argues that "your mind or soul is the cumulative flow of your experience [over time]. You have a sense of self because of this continuity" [33] (p. 49).

In Table 1 summarize the key claims of substantialist metaphysics presented comparatively with those of relational process metaphysics, discussed in this section.

The major focus of substantialist metaphysics is the question of "what there is" implying its primary concern with Being. It is things, entities or subjects as self-contained, bounded, enduring substances that are seen as foundational constituents of reality. Things, entities or subjects (such as technologies, organizations, individuals) have properties that define them. These properties may change without changing their substances (as in the wax example). Changes of properties occur due to relationships between things, subjects or entities, which is a way to recognize the existence of processes in substantialist metaphysics. Processes are thus derivative concepts as they are processes *of* specific substances involving the change of properties.

Process thinkers draw from our intuitive understanding of reality as flows and dynamic relational processes that we experience in our everyday lives. Process metaphysics reflects our experience of ongoing dynamics of our lives and the world we live in and integral to them the ongoing becoming of entities (individuals, organizations, information systems) that are only temporally stabilized in the course of events.

Process philosophy starts from experience and encourages us to open up our thinking to the richness and depth of our experience and intuition. Seibt [34] notes that "process philosophers (e.g., Whitehead) argue that the traditional notion of substance (a time-invariant, necessarily located particular) precisely lacks any experiential grounding, while process philosophy can draw on the experience we are most intimately familiar with, namely, the way in which we experience ourselves".

Process metaphysics thus differs fundamentally from substantialist metaphysics by not focusing on "what there is" but instead on "what is occurring" and "ways of occurring" (see Table 1). Process metaphysics therefore considers processes as fundamental constituents of reality and gives primacy to "becoming" as the "mode of

[1] The contesting also goes the other way around as the "revolt against process" thinking in contemporary philosophy [43].

Table 1. Comparative assumptions of substantialist and process metaphysics

	Substantialist metaphysics	Process metaphysics
Major focus	Substantialist metaphysics is concerned with "what there is"	Process metaphysics is concerned with "what is occurring" and "ways of occurring"
Foundational constituents of reality	Primary units of reality are things, subjects or entities as enduring, self-contained, bounded *substances*	The primary units of reality are *processes*: reality is conceived as confluence of processes
	Substantialist metaphysics gives primacy to *beings* – things, subjects, entities or substances defined by properties or qualities	Process metaphysics gives primacy to *becoming* as "the mode of being" as well as the "processes that generate different kinds of dynamic beings"
Other constituents of reality: derivative concepts	Processes are ontologically understood as modifications of properties typically due to relationships between substances; while properties may change through processes substances persist, remaining what they essentially are	*Being* is constituted by its becoming; being is dynamic, created in relational processes
	Processes are "owned", they are processes *of* specific substances (reductionist view of processes)	Persistent entities are *enduring* patterns of processes (Whitehead)
The notion of time	Time is considered universal, absolute, linear and measurable	Time is inherent in processes, an inextricable part of a lived durée (Bergson)
	Time, as "clock-time", measures movement and events in space	There is no singular absolute clock-time but rather a multiplicity of clock-times that belong to multiple processes (realities)

being" as well as the processes that generate different kinds of "dynamic beings" [4, 34, 37, 43, 46]. Reality is conceived as a web of relational processes [33] or a "confluence of processes" [47] that are continuously coming about.

In response to attempts to downplay the distinctive processual thinking Rescher [4] critiqued what he calls the "process reducibility thesis" that portrays processes as changes of things universally accepted as existing in nature. Rescher later wrote:

> What is characteristically definitive of process philosophizing as a distinctive sector of philosophical tradition is not simply the commonplace recognition of natural process as the active initiator of what exists in nature, but an insistence on seeing process as constituting an essential aspect of everything that exists – a commitment to the fundamentally processual nature of the real. For the process philosopher is, effectively by definition, one who holds that what exists in nature is not just originated and sustained by processes but is in fact ongoingly and inexorably characterized by them. On such a view, process is both pervasive in nature and fundamental for its understanding. [48]

It is the processual nature of reality, the pervasive, ongoing, relational processes that are foundational and thus of primary interest in our quest for understanding the world and anything in the world. In other words, anything that we experience in the world is always in becoming. What we call things, objects, subjects, personalities, organizations, technologies, are not fixed, free-standing, bounded individualities but dynamic, fluid, emergent, temporally stabilized beings. Being is thus constituted by its process of becoming actuality as, in Whitehead's words, "[t]he actual entities … make real what was antecedently merely potential" [37] (p. 72). This implies, as Introna notes, that:

> In their actuality all beings are ontologically open (and as such ontologically malleable and emerging) … no being/entity is ever "complete" so that this complete entity can then have relations with other entities (in such "completed" terms) which are then somehow external to its own constitutive becoming (Whitehead, 1978, p. 59) – becoming is not "between" but always within, and as such, constitutive of actual entities. [26] (pp. 332–333)

Beings are understood as "epiphenomena of primary fluxing and changing patterns of relationships and event clustering" [49] (p. 283). When we experience organizations and technologies as stable and ordered we need to look within, beneath and beyond them to uncover their "becoming" or "occurrence" and how they become accomplished as "impermanent patterns" of ceaseless relational processes.

Time in substantialist metaphysics is taken to be universal, absolute and objective as is postulated in Newtonian physics. Time measures movement and events in space. Time runs uniformly, in a linear fashion and can be divided into discrete units. "Clock-time" is measured precisely according the World Standard Time.[2]

In process metaphysics time is intimately linked to processes. The flow of process cannot be separated from the flow of time. Developments in physics in the early 20th century, and in particular Einstein's theory of relativity, revealed that measuring time is relative to a reference system and cannot thus be absolute [50]. Process thinkers together with contemporary physicists:

> reject the Newtonian view that time and space exist as some fixed background or framework separate from the events that happen within them as if time and space form the bottle around us that would still exist even if all events disappeared. Time simply is the passage – the becoming and perishing – of events. [33] (p. 43)

Drawing from Einstein, Bergson conceptualized time as "experienced time", a "real time", a lived "durée" as part of the flow from past into future. For Bergson, the real time duration is different from linear, "measured time": "Our duration is not merely one instant replacing another; if it were, there would never be anything but present – no prolonging of the past into the actual, no evolution, no concrete duration. Duration is the continuous progress of the past which gnaws into future and swells as it advances …" [51] (p. 4). The dynamicity of our experience implies its own time, the past (memory) that lives in the present as it is becoming (creating) a future. In process metaphysics time is of central importance for appreciating and dwelling in processes.

[2] The World Standard Time agreed 1 October 1884 included 24 time zones and Greenwich as the zero meridian [50].

4 Reflections on Substantialist Metaphysics Underlying IS Research and the Shifts Towards Process Metaphysics

4.1 IS Research Underlined by Substantialist Metaphysics

From its beginning the Information Systems discipline eagerly embraced substantialist metaphysics following other business disciplines seeking legitimacy of a proper scientific discipline [52]. IS research in the 1970s and 1980s was motivated by the development and deployment of IT in organizations and the increasingly evident implications on employees, quality of work, decision making processes, productivity, efficiency and effectiveness, organizational performance and power and organizational structures, e.g. [53, 54]. IS researchers tended to adopt a positivist research paradigm, assuming that the world consists of discrete entities – human beings, organizations, technologies, processes, products, accounts and others – that exist independently of observers [8]. These entities are characterized by inherent and largely stable properties and relationships that can be unproblematically studied, measured and mapped. The aim of research was to discover causal relations among phenomena of interest so that they can be explained and predicted. Researchers thus developed research models that define constructs (variables) to represent (and measure) relevant entities and hypothesized relations among the constructs (assuming one-to-one correspondence with the real world). For example, the technology acceptance model defined two variables, "perceived usefulness" and "perceived ease of use", which are causally related as fundamental determinants to the variable "user acceptance of technology" [55]. The research models are then empirically tested in order to either verify or falsify the hypothesized causal relations, following the hypothetic-deductive account of scientific explanation.

Of particular interest to positivist research is how information systems and information technologies (IS/IT) as an autonomous, exogenous force impact on organizational processes and structures [17]. This view of IT/IS was based on the assumption that "[a]n information system is an artefactual *representation* of a real-world system as perceived by someone, built to perform information processing functions" [56] (p. 62, emphasis in original). While positivist IS researchers widely assumed such a view they rarely expressed explicitly their ontological assumptions. A notable exception is found in Weber [57] where fundamental ontological concepts and their derivatives are defined (based on Bunge's [58] generalized ontology) as a foundation for the evaluation of IS theories [57] (p. 3):

- The world is made of things. Things can be substantial or concrete (e.g., an information system user or a computer); alternatively, they can be conceptual (e.g., a mathematical set of a function). …
- All concrete things in the world possess properties … Similarly, all properties in the world attach to some thing … For example, a human (a concrete thing) may possess a property that he uses an information system, and a computer (a concrete thing) has a property of possessing a certain amount of internal memory. …
- The way in which we perceive a property at a point in time (our representation of it) is called an attribute. Various types of attributes exist …

- A vector of attributes in particular represents a state of a thing (its attributes in general along with their associated values). …
- An event that a thing undergoes is represented by a change from one of its states to another of its states (at least one of its attributes change values). …
- The history of a thing is a sequence (ordered set) of its states (e.g., the states that a thing traverses over time are ordered by time). …
- Two things interact when the history of one thing is not independent of the history of the other thing. …

These concepts represent a paradigmatic case of substantialist metaphysics that has underpinned much of mainstream IS research since its early days (although not necessarily articulated so precisely and exhaustively). In Weber's ontology reality consists of things characterized by attributes and states, and also events when things change their states. Such a view of events is consistent with the substantialist metaphysics' reductionist view of process – an event is defined as the change of a thing's state.

By defining what exists in the world, metaphysics also circumscribes what is studied, what is considered credible evidence and how justifiable knowledge is generated. Substantialist metaphysics provided the foundation to study information systems, information technologies, individuals and organizations as discrete, self-contained, describable entities represented as variables allowing for empirical testing of nomological statements about their behaviour – cause and effect relationships among variables, representing objectively what is the case in the world. For instance Daft and Lengel's, Media Richness Theory [59] posited that communication media affect users' ability to communicate and change understanding. IS/IT in these studies are often presented as causal determinants of organizational change [17]. Grounded in substantialist metaphysics and representationalist epistemology positivist research exemplified the scientific ideal to study and objectively establish IS/IT effects across time and space, independently of their particular use in any concrete social setting [56, 60].

While the positivist paradigm dominated and continues to dominate mainstream IS research, it has been subjected to critique and its limitations have been debated from various perspectives. The key issue is the disregard of social and historical conditions and contexts of IS development and use, which limits the understanding of these processes and their effects. Assuming one-dimensional causal relationships among IS/IT and human and organizational effects, many positivist studies adopt a form of *technological determinism* [18, 61]. Positivist studies test predefined relations among variables and thus are not "conducive to the discovery and understanding of non-deterministic and reciprocal relationships" [8] (pp. 12–13). Furthermore, by abstracting to variables and across contexts, positivist studies, Ramiller and Pentland argue, remove participants' meanings, history and also content (actors, actions and artifacts) which as a result disconnect research results from practice [62].

4.2 A Shift Towards an Interpretive Approach and Social Constructivism

During the 1980s and 1990s significant attempts were made to overcome the limitations of the positivist approach by focusing on social contexts in which IS/IT are developed, deployed and used and in which they are interpreted and enacted thus becoming part of social and political dynamics [12, 18]. The interpretive approach, boosted by the Manchester 1984 Conference [9], introduced new views on information systems and organizing within complex social and historical contexts that departed from substantialist metaphysics and technological determinism.[3] The interpretive research approach assumed the subjective and socially constructed nature of IS/IT and organizations and the emerging processes of their mutual shaping and co-construction. Interpretive researchers thus believe that a relevant reality cannot be isolated and measured in an "objective" way and independently of researchers, but instead argue that reality is always interpreted (by people studied and by researchers) in a value-laden and subjective manner.

Kling and Scacchi for example proposed the web ontology of computing that explains how computers became enmeshed in webs of social relationships by making explicit the "salient connections between a focal technology and its social and political context" that help understand "the dynamics of computing development and use in organizational life" [66] (p. 3). Markus [67] examined the organizational power and politics and how they become implicated in the dynamics of MIS implementation. Another example of the social constructivist view concerns studies on IS project success or failure. Assuming interpretive flexibility of IS projects, their success or failure is not seen as an objectively existing end state, but instead is considered to exist only as an interpretation or construction by relevant social groups, see e.g. [68].

A distinct stream of interpretive research has been informed by Giddens' theory of structuration [69] that transcends the subjective/objective polarization of social reality [12]. Drawing on Giddens' theory, Orlikowski proposed a "structuration model of technology" that allows a "dialectic understanding of interaction between technology and organization" [70] (p. 398). The model assumes "interpretive flexibility of technology" that refers to the "degree to which users of a technology are engaged in its constitution (physically and/or socially) during development or use" [70] (p. 409), thus depending on the technology, human agents and the context.

Interpretive research opened up new ways of thinking about, investigating and theorizing complex questions of IS/IT and organizing. It made distinct contributions to understanding the transformational processes involved in technology deployment and the subjective, local and contextual meaning of technologically mediated work and managing practices. For instance, Walsham, one of the prominent champions of

[3] This was part of a larger, often called reformist movement of qualitative research and the adoption of interpretive philosophies in social sciences that began in the 1970s as a reaction to positivist social science [63–65].

interpretivism in IS, articulated the new metaphysics of information systems and organizing:

> Computer-based information systems embody interpretive schemes in the sense that they provide ways of viewing the world and thus making sense of it. They also reflect norms and values concerning what are desirable states of the world or what can be achieved. Finally they provide a facility that can be used in the control and co-ordination of material and human resources. [71] (p. 235)

> Computer-based information systems may thus be associated with elements of changed social structures, but its use can also reproduce existing structures of meaning, power and morality; or, in other words [they] are associated with a blend of social reproduction and change. … Important elements of change… include new forms of work activities, new roles and involvement with others, and thus new identities at work for individuals and their perception in the eyes of the others. [71] (p. 236)

To understand an information system, what it is and what it does, we must grasp the interpretive schemes they embody and the ways their use mediates social actors' interpretation, meaning making and actions in organizational contexts. An information system thus does not "mirror" (independently existing) objects from the real world but rather represents a particular interpretation of the real world which in turn participates in the construction of the real (e.g. social reproduction of structures or change, [12, 72]). While information systems are technologically realized their meaning, use and effects in the social context are socially constructed, together with everything else in the social world. The development, implementation and use of information systems and their implications in organizations and society cannot thus be understood independently of social actors, their lifeworlds, meaning systems, cultural and historical backgrounds, and emerging social processes. Interpretive IS research is not aiming to isolate, explain and predict IS phenomena but rather to contribute to the understanding (*Verstehen*) of IS phenomena in practice, see e.g. [8, 17, 23, 71, 73].

Interpretive researchers can be seen as trailblazers that moved away from substantialist metaphysics, seeking new ways of seeing and thinking about reality as socially constructed, and focusing on subjectivity and objectivity, agency and structure, processes and temporality, sociality and materiality. They revealed exciting new possibilities to engage in actual processes of embedding and enacting IS/IT in various social and organizing contexts and generating knowledge by drawing from human subjectivity while not sacrificing the objectivity of knowledge [65]. However, the interpretive approach faced some significant criticism, often by its key protagonists.

First, interpretive researchers engage and observe reality while aiming to remain objective and external to it. As Schwandt remarks, "in interpretive tradition, the interpreter objectifies (i.e. stand over and against) that which is to be interpreted. And, in this sense, the interpreter remains unaffected by and external to the interpretive process" [65] (p. 194). In addition Latour [74, 75] critiqued social constructivism for privileging human beings and disregarding other heterogeneous agents in performing reality.

Second, interpretive researchers struggled with the plurality of subjective perceptions, interpretations and constructions of reality (e.g. of IS implementation and success) by different social groups. The problem with plurality of interpretations, as Mol [76] and Law [77] extensively discuss, is the assumption of a single underlying reality of which different social groups have different perceptions and interpretations. They

instead argue that multiple realities are often enacted and that this is not a question of epistemology but ontology.

And the third objection, expressed by Leonardi and Barley, is that the "swing away from technological determinism toward social constructivism, which began in the 1980s, has gone too far" [12] (p. 3). The key issue I would add following Latour [74] is that social constructivism with its central preoccupation with human perceptions and interpretations has not taken seriously into account participation and contribution by non-human actors in the construction of reality. Most importantly, while social constructivist metaphysics moved away from substantialist metaphysics it has not gone far enough towards adopting and applying process thinking.

4.3 A Shift Towards Relational Ontology and a Sociomaterial Approach

The movement towards relational ontology is contrasted to substantialist metaphysics [78] as well as social constructivism [74, 75]. Relational ontology assumes that humans, technologies and things emerge through relations in practice: they do not pre-exist as entities (with given or interpreted properties and boundaries) but are instead created and continually recreated through relations. The founding assumption is that relations are primary and relata secondary [79, 80]. Everything that exists is thus always in becoming as relational effects. As we can see relational ontology has striking similarities with process metaphysics as their assumptions and orientations clearly overlap. Mesle [33], for instance, explicitly articulated process-relational metaphysics. Shotter [81] draws on relational ontology and Barad [79, 80] among others to explore process orientation in practice. Introna referring to Bergson and Whitehead, claims that entities with pre-existing quality do not exist in actuality but are the "emergent accomplishments of becoming" [26] (p. 332) through relations that are constitutive of their very beings. However, only a handful of authors recognize metaphysical resemblance among the relational ontology and process metaphysics [26, 47, 81, 82].

The movement inspired by relational ontology involves several parallel streams of research in science and technology studies (STS) and actor-network theory (ANT) in particular, e.g. [75–77, 83–86]; feminist and science studies, e.g. [79, 80, 87]; and many others. Drawing from these streams and specifically Barad's agential realism [79, 80] a sociomaterial approach was recently proposed in IS and organization studies [16–18, 88]. The sociomaterial approach emerged at a particular time when it became increasingly more difficult to disentangle information and communication technologies from work practices, organizing and socializing, public and private lives. It assumes an ever-changing world that is continuously re-constructed and re-assembled out of heterogeneous materials.

One of the founding concepts of the sociomaterial approach is the entanglement of humans and non-humans, the social and the technological (material), that is, heterogeneous actors who continually co-construct reality and at the same time co-constitute each other. Actors are thus actual accomplishments of heterogeneous assemblages. To

understand the dynamics of their entanglement Barad proposed the concept of intra-relating and intra-action:

> To be entangled is not simply to be intertwined with another, as in the joining of separate entities, but to lack an independent, self-contained existence. Existence is not an individual affair. Individuals do not pre-exist their interactions; rather, individuals emerge through and as part of entangled intra-relating. Which is not to say that emergence happens once for all, as an event or as a process that takes place according to some external measure of space and time, but rather that time and space, like matter and meaning, come into existence, are iteratively reconfigured through each intra-action, thereby making it impossible to differentiate in any absolute sense between creation and renewal, beginning and returning, continuity and discontinuity, here and there, past and future. [80] (p. ix)

The ongoing processes of becoming are thus temporal, based on lived time rather than clock time, a view that features prominently in process metaphysics.

While talking of becoming through relations Barad assumes that all relations are internal to the becoming of actors [80], implying that the actors are never "completed" [26]. They may be stabilized, performed as particular actors with particular properties and relations, by what Barad [80] calls "agential cuts". Agential cuts are local resolutions of ontological openness, implying no authors of the performative outcomes. In Introna's words, "[i]n the ongoing flow of becoming there is no author (or authority) as such. There is no actor 'outside' the heterogeneous assemblage that can intra-act with it and somehow not become implicated in the performative outcome" [26] (p. 338).

The sociomaterial approach, as Orlikowski and Scott [18] emphasize, adopts a posthumanist notion of performativity that decentres the human and "incorporates important material and discursive, social and scientific, human and nonhuman, and natural and cultural factors" [79] (p. 808). By adopting posthumanist performativity they follow Barad who questions and rejects the notion of agency that is located either in humans or in objects (technologies):

> Agency is a matter of intra-acting; it is an enactment, not something that someone or something has. Agency cannot be designated as an attribute of "subjects" or "objects" (as they do not preexist as such). Agency is not an attribute whatsoever – it is "doing"/"being" in its intra-activity. [79] (p. 827)

It is important to note that Orlikowski and Scott proposed the sociomaterial approach as an attempt:

> to move beyond the separation of the technical and the social. For researchers [adopting the assumptions of relationality and becoming] practices are always sociomaterial, and this sociomateriality is integral, inherent, and constitutive, shaping the contours and possibilities of everyday organizing. As Barad (2003, p. 818) puts it, "Agencies are not attributes [of either humans or nonhumans] but ongoing reconfigurations of the world." Thus, an important challenge for research going forward is developing ways of thinking and talking about the social and material worlds as inseparable, as constitutively entangled. [18] (p. 463)

Given its grounding in relational ontology, the hallmark of the sociomaterial approach is ontological inseparability of the social and the technical and their constitutive entanglement – clearly distinguishing the sociomaterial approach from other approaches (in particular the positivist and interpretive).

Early work by Orlikowski [16, 17] and Orlikowski and Scott [18] stimulated a stream of empirical studies that contributed to the sociomaterial scholarship [29], of which I'll mention only a few.

In an early attempt to adopt a sociomaterial practice perspective [18] Wagner et al. [89] explore the survival of an Enterprise System (ES) project. They conceptualize ES as a sociomaterial assemblage that disturbs the previous sociomaterial assemblage of legacy practices and thus produces resistance at rollout. By exploring the processes of mutual accommodation and adaptation of the social and the technological during the post-rollout phase they demonstrate how resistance is accommodated through sociomaterial adaptations. The authors contribute to changing discourse on ES projects from *best practice* to *negotiated practice*, demonstrating how project survival often depends on sociomaterial adaptations and negotiations well beyond the rollout phase.

The work by Østerlie et al. [20] is another example of sociomaterial scholarship. The authors provide an account of *dual materiality* of the undifferentiated phenomena of well flows in petroleum exploitation (e.g. liquids, gases and sand) and the information system (arrangements of sensors, computer equipment and algorithms) used by the engineers as part of practice. They contribute to the discourse on sociomateriality by "refining ideas of materiality, which has thus far been predominantly limited to the materiality of technological artifacts. Dual materiality highlights how IS becomes important, as its materiality plays an integral part in creating, not simply representing, the materiality of the physical world" – in their case the well flow [20] (p. 102). The notion of dual materiality, as the authors indicate, is an instance of Barad's [80] phenomenon-instrumentation relationship.

A sociomaterial ethnography of planetary exploration at NASA (a mission orbiting an outer planet in the solar system) by Mazmanian et al. [90] draws on Barad [79], Haraway [87] and Suchman [88] and explores "how physical, social, material, technological and organizational arrangements dynamically reconfigure each other in the durée of organizational practice" [90] (p. 831). They contribute further theorizing of the notion of constitutive entanglement of the social and the technological/material by explaining the dynamic reconfiguration of the people, social structures, information technologies and representational objects in practice.

Based on a comparative study of the UK-based AA hotel evaluation system and online evaluations on TripAdvisor (a form of crowd-sourced content) Scott and Orlikowski [15] explore the phenomenon of anonymity. In contrast to the dominant view on anonymity as a social phenomenon – a static attribute of an agent or a system – they show how anonymity is performed differentially by material-discursive practices of the AA and TripAdvisor evaluations. Drawing from Barad's agential realism [79, 80] the authors demonstrate that anonymity is an enacted accomplishment of these practices. The authors explain how such enactments of anonymity through specific material-discursive practices generate different agential cuts, that is, a particular hotel ranking by the AA system and the other by TripAdvisor, with serious performative effects in the hospitality sector. This paper has broader implications for understanding the performative effects of openness and (lack of) accountability of social media and crowd-sourced content drawing attention to their emerging consequences in everyday practices of knowledge production and consumption.

The sociomaterial approach, together with other research streams founded on relational ontology, are breaking new grounds in understanding the dynamic, uncertain and technologically impregnated world differently. The move towards the sociomaterial approach, I suggest, signifies a move towards process thinking. While the original proposal for the sociomaterial approach does not explicitly draw from process metaphysics, its foundation in relational ontology is processual in nature. Furthermore, some researchers like Introna [26, 82, 91] and Shotter [81] who engage seamlessly with the relational and the process metaphysics demonstrate their ontological kinship and shared roots.

While the sociomaterial approach has been debated for a about decade, the IS research community is yet to appreciate its distinct nature and novelty and understand the intellectual expansion of research possibilities that it enables. The problem, however, is that the debate on sociomateriality was framed within the dualist worldview and substantialist metaphysics. The radical nature of relational ontology that underpins the sociomaterial approach has been misunderstood, denied or plainly claimed wrong. The debate on sociomateriality has turned into a discussion on the importance and distinct nature of the material (including technology) and its relation to the social [25, 30]. Sociomaterial accounts are critiqued for their alleged failure to define the material (its "intrinsic properties") and to explain entanglement, e.g. [25, 30, 92]. The sociomaterial approach is thus questioned and assessed on the grounds of substantialist metaphysics leading to claims that it is a "wrong turning" [27]. It is particularly intriguing that the sociomaterial approach has been critiqued and redefined, precisely based on substantialist metaphysics that it rejects! Kautz and Janson [93] refer to these opposing views as different "camps" and alert the research community to the controversy and confusion emerging in the IS and organization studies debate on sociomateriality.

There are now different conceptions of the sociomaterial approach [93] and the confusion in the literature as to what it is that the term denotes. Conflating different ontological positions has been detrimental to the development of the sociomaterial approach. The key problem of course has been the lack of appreciation and understanding of the relational ontology and processual thinking as well as the radical departure from substantialist metaphysics that the sociomaterial approach exemplified.

While the above exploration is out of necessity limited (omitting numerous authors and works that deserve mention) it shows that the road from substantialist to processual thinking has been a difficult one and that the journey has had many obstacles and distractions. The debates in IS have more often obscured rather than clarified the differences in research approaches and their implications. Grounding our debates in metaphysical assumptions, as I tried to do here, might help IS researchers better understand the paradigmatic differences and controversies and engage in a more constructive dialogue.

5 Concluding Remarks

As the IS discipline experiences shifts from positivist to interpretive to sociomaterial paradigms we are caught up in a long-standing controversy between the substantialist and process metaphysics without recognizing its foundation or understanding its

historical roots. The paradigm debates, especially those related to the emergence of interpretivism and the more recent confrontation among the so-called different camps of the sociomaterial approach, have been fought within an intellectual climate largely informed, although not necessarily explicitly, by Burrell and Morgan's paradigm model [1]. These debates in many respects obscured the deep underlying metaphysical differences and thus led to poorly articulated conflicts and confusing argumentation.

In this paper I propose a different grounding for our paradigm debates: the distinction between substantialist and process metaphysics. By briefly reviewing their historical developments and summarizing their key differentiating assumptions, I offer the conceptual foundation to examine and reflect on paradigm shifts in IS research from positivist to interpretive to sociomaterial. This discussion shows how the proposed metaphysical grounding contributes to the contemporary IS paradigm debate by revealing new insights into differences among research paradigms as well as sources of conflict and confusion.

Substantialist metaphysics has dominated Western thought, languages, education and socialization. We have grown up believing that things have a nature that is fixed and describable and that through our inquiries we are representing this nature ever more accurately and thus usefully. The IS discipline has been built on this tradition and has seen remarkable development grounded in substantialist metaphysics. It is therefore not surprising that departing from substantialist thinking and opening new ways of thinking about, investigating and theorizing complex questions of technologies and organizing have been difficult and often obstructed. Similar to other social sciences, the IS discipline has been struggling to find ways to go beyond substantialist metaphysics and advance research based on alternative worldviews.

It is important to note here that while the choice of a paradigm can be more or less compellingly argued it cannot be scientifically justified based on some fundamental assumptions and evaluative standards as these very assumptions and standards characterize the paradigm in question. "In paradigm choice – Kuhn contends – there is no standard higher than the assent of the relevant community" [5] (p. 94). When one group "uses its own paradigm to argue in that paradigm's defense" [5] (p. 94) it uses a circular argument. To advance the paradigm debate further we need to explicate and reflect on metaphysical assumptions and argue for a novel paradigm based on its ability to identify and deal with relevant phenomena. This becomes particularly important when a new metaphysics is proposed that challenges the dominant, widely accepted one, due to inevitable misunderstandings and the risk of dismissing research contributions founded on unknown and unaccepted set of assumptions.

While a paradigm choice cannot be scientifically justified (or proven right or wrong), it can nevertheless be clearly explained and persuasively argued for. The metaphysical grounding of the paradigm debate can help advance scholarly communication and nurture critical discourse. Explicitly reflecting on metaphysics and confronting different philosophical foundations of our research might actually be revealing and act like a *gestalt switch* to help us open up new ways of looking at and seeing the world.

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Critical Realism and Actor-Network Theory/Deleuzian Thinking: A Critical Comparison in the Area of Information Systems, Technology and Organizational Studies

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Abstract. Much debate has encircled studies of information systems (IS), technology and organizations with regards to ideas of process, stability and change, performance and materiality. This encapsulates different ways of viewing dualities (e.g. subjective/objective, social/technical, local/global, macro/micro, structure/agency, reality/construction, being/becoming, etc.) as well as alternative ontological and epistemological commitments underlying particular approaches and research perspectives. This paper seeks to explore two specific approaches by focusing on a comparison of critical realism (CR) and actor-network theory (ANT)/Deleuze-inspired forms of inquiry. In particular, we focus on the notion of morphogenesis in order to explore in greater detail how this concept conjures up rather different images in relation to approaches centred around CR and ANT/Deleuze.

Keywords: Information systems · Technology · Organizations · Critical realism · Actor-network theory · Deleuze · Process · Ontology

1 Introduction

Realism, positivism and structuralism have dominated the areas of information systems (IS), technology studies and organizational research as well as other disciplines in the social sciences and humanities (e.g. sociology, linguistics, psychoanalysis, etc.). Although this has taken many forms, realism traditionally tends to assume a singular reality existing "out-there" independent of our actions and preceding any attempt to know it. Subjects, objects and causal relations are also deemed to exist in an independent form that can be clearly defined and represented [1]. In addition, a structuralist perspective focuses on how certain structural factors determine specific outcomes and patterns of behaviour with regards to individuals and groups within society [2].

While realism and structuralism remain as prevailing forces underlying many studies and texts within the fields of information systems, management and organization studies, a variety of approaches have emerged seeking to challenge this way of thinking. Albeit not an exhaustive list, this notably includes: social constructivism [3]; ethnomethodology [4];

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critical realism [5–10]; phenomenology [11, 12]; symbolic interactionism [13]; structuration theory and sociomateriality [14–16]; actor-network theory [17–19] and Deleuzian thinking [20, 21]. In addition to sharing concerns with realist approaches to the study of information systems and organizations, they also seek to attend to the multiplicity, heterogeneity and complexity of meanings, interpretations and interactions associated with the highly contingent nature of informational and organizational worlds.

This paper seeks to contribute to the wealth of fascinating and insightful pieces on information systems, technology and organizations by examining in detail two contrasting lines of inquiry, namely critical realism (CR) and actor-network theory (ANT)/Deleuze-inspired approaches. More specifically, the paper seeks to examine how they differ in their understanding of ideas of process, performance, reality and construction and stability and change and how this impacts on their approach to issues of objects, ontology, action and agency in relation to certain dualist categories (structure/agency; macro/micro; being/becoming; social/technical). In doing so, we do not wish to reinforce strict divides between these two approaches or assume that they exist in some coherent form based on fixed categories (as clearly there is much diversity and difference within and between the approaches). In contrast, the aim of the paper is to explore how certain images and ideas overlap, where certain differences may transpire (in terms of assumptions and commitments) and how different commitments may impact on the study of process, performativity and everyday practice. More specifically, this paper examines how these two approaches attempt to deal with the problems of viewing "reality" as possessing a stable or definitive status (e.g. "out there" or "in here", whether that be in an essential, natural or socially constructed form[1]), while also wishing to avoid a situation of deconstructing everything until there is nothing left. This includes exploring how apparently opposing dualities, such as stability and change (or homogeneity and heterogeneity, difference and repetition, real and construction) are actually counterparts that require the accompaniment of their travel partners on each journey. Therefore, rather than placing these concepts in opposition, this paper seeks to question how we can find ways of becoming increasingly sensitive to the variety of information practices and organizational worlds in ways that allow the researcher to engage with the different assemblages, connections and associations that bring all of this to life through a study of morphogenesis.

To conclude, this paper seeks to explore how these two different perspectives approach the study of IS, technology and organizations with regards to ideas of stability and change, structure and agency, sameness and alterity, and process and performativity with particular attention to the concept of morphogenesis. This includes highlighting the importance of ideas and concepts that have emerged through the work related to critical realism, actor-network theory and Deleuze and how these have contributed to our knowledge and understanding of information, technology and organizational

[1] While a shift from epistemology to ontology may provide a way of keying into the process of construction which is less centred on human meanings and interpretation (e.g. social constructivists may reject the idea of a natural world existing out-there, however, this can be replaced by a socially constructed view of objects), the problem of identity still remains with a focus on existence and being.

studies. Additionally, in order to attend to the messy worlds of complexity and controversies that underlie our research settings, we wish to explore the different vocabularies, conceptual tools and methodological sensitivities attached to these approaches. The paper therefore seeks to provide a modest contribution to the development of concepts and methodologies that enable researchers to engage with and account for the multiplicity of everyday practices and the complexity of informational and organizational lives, by delving into the different ontological and epistemological commitments underlying these different approaches.

In order to explore these issues and questions further, we will first begin by providing a brief overview of the main ideas and specific commitments relating to the research underlying CR and ANT/Deleuze. We will then investigate these issues further by exploring how the different approaches direct our attention ontologically and epistemologically with regards to the study of information, technology and organizations.

2 Critical Realism

Critical realism is often associated with the work of Bhaskar [5] and in part emerged from his work in transcendental realism and critical naturalism. While the transcendental realist model of science is seen as equally applicable to the physical and human world, critical realism highlights the need to adapt this approach to suit the greater levels of change and alterity associated with the social world. While the problem of predictability in the social world is seen as a concern within CR, the fear of falling into the relativist trap of uncertainty brings CR back searching for certain links between effects, causal mechanisms and structures. For Bhaskar [22], there is a reality out there beyond our thoughts, beliefs and impressions that can be described in three levels: the empirical (experienced events); the actual; and finally the causal (the mechanisms which generate events). While the causal level may not be directly observable, for Bhaskar it is real and distinct from the domain of the empirical. If we take the example of magnetism and iron filings, the empirical may indicate that the filings follow a particular pattern. However, to explain why this occurs we must accept that there is some unseen causal mechanism operating (in this case, magnetism). From this perspective, the natural world is seen as comprising of heterogeneous systems with their own mechanisms, which when combined can produce less predictable effects.

Rather than presenting a hard determinist approach, mechanisms are seen as tendencies, and attention is directed to understanding and explaining these tendencies. For instance, while a traditional realist will use experiments to study how an infectious agent will cause and produce certain effects, the critical realist may describe how a subject may be infected, but remain healthy (e.g. because of their immunity to the infection or ameliorating effects of their own social conditions). Additionally, more than one mechanism can operate at one time and causal laws should be examined in relation to their

tendencies.[2] Thus, tendencies can be possessed and unexercised, exercised and unrealized, realized and unperceived [22]. When applied to individuals, the critical realist therefore distinguishes between people's action as influenced by innate psychological mechanisms as well as wider social conditions. Society is thus seen to have more mechanisms at work than the natural world and the possibility of solid prediction is greatly reduced. The social scientist is therefore encouraged to focus on the identification, analysis and explanation of these different tendencies and mechanisms. Thus, while critical realists acknowledge the active role of individuals, they also highlight the role of structural factors in transforming and governing outcomes within their social world.

In order to identify the underlying generative mechanisms that produce manifest phenomena as observable, contingent tendencies or patterns, Bhaskar [22] seeks an essential unity of method between natural and social structures [23]. A categorical distinction is required between human action and social structure (as properties of the latter differ in the ways they pre-exist the former through which they are transformed or reproduced) and social structures are seen as existentially interdependent although essentially distinct to human action [5]. To link action to structure, the researcher is required to identify the slots in the social structure where active subjects must slip, in order to reproduce it. Rather than existing in some mechanical determinist form, social structures are viewed as multi-layered, stratified, relational and existing in pre-structured contexts.

Uncovering structural mechanisms and tendencies that are viewed as leading to instances of oppression and exclusion is also central to certain critical realist texts. This can include developing a hypothesis about the underlying mechanisms that generate specific oppressive patterns and examining these in more detail in order to assess the adequacy of the explanation (possibly deriving new hypotheses and testing them if required). This is seen to enable any identified oppressive mechanisms to be exposed and challenged. A comparison between the hypothetical-deductive method and CR highlights how the former focuses on the experimental level of observed phenomena, while CR describes the impact of unseen events and tendencies on outcomes and effects. (i.e. rather than simply A causing B, they introduce a C which can have profound effects on outcomes).

Various writers such as Archer have sought to translate, develop and further modify previous work in CR leading to alternative ways of engaging with ideas of stability and change. For instance, she explains how [6] (p. 376 in [8] p. 203) "action is a continuous, cyclical, flow over time: there are no empty spaces where nothing happens, and things do not just begin and end". This requires a greater engagement with how past actions influence how structures are enacted and performed[3] and the process of structural conditioning in terms of constraining or enabling social interaction that either transforms or reproduces structures and actions in the future [6]. The influence of Archer and more

[2] While the critical realist is aware of how access is mediated there is also a sense that it is possible to get closer to the true reality of things.

[3] Even though Archer and Latour have very different ontological commitments with regard to objects, structures and relations. It is interesting to see how both have an interest in how actions distributed elsewhere may assemble through particular mediations.

recent work in this area is particularly noticeable within the IS and organizational studies literature connected to CR [7, 24–29]. This includes a special issue on CR and IS [10] and additional research that seeks to study the complex relationship between IS, technology and organization.

While it is interesting to consider the overlapping interests aligning CR and ANT/Deleuze-inspired approaches, it is also crucial to take account of the critical differences that set them apart. In order to explore these further, the next section provides a very brief overview of certain ideas and conceptual thinking relating to ANT and Deleuzian thinking.

3 Actor-Network Theory and Deleuzian Lines of Inquiry

ANT sets to examine how "actors and organizations mobilize, juxtapose, and hold together the bits and pieces out of which they are composed" [1] (p. 386). In other words, ANT seeks to explore how certain assemblages are created, maintained, fabricated, controlled and negotiated by the continuous performance of processes and practices [1, 30, 31]. This examination of reality, truth and fact-making practices relies on a focus on the processes of construction, translation and mediation through a commitment to avoid any reliance on certain *a priori* divides and principles [31]. This includes a focus on becoming in terms of mapping controversies, assemblages, heterogeneous engineering and distributed action. For ANT, the world is full of verbs and a continual process of morphogenesis in the sense of subjects and objects in the making (highlighting the need to attend to "things in the making" rather than things merely existing).

While ANT attends deeply to the process of construction, this is very different from the typical understanding of constructed as aligned with "socially constructed", i.e. made of "social stuff" that is often human-centred [32]. Rather than viewing the social as something centred around human endeavours, Latour [32] argues that the social relates to the process of associating, as reality is considered as the outcome of these multiple processes of translation, mediation and complex associations. Furthermore, rather than relying on either human or non-human actors in command, this take on construction implies that agency is distributed among relational encounters over which there is no single control or mastery. Mediators and realities are therefore made of heterogeneous relations that have their own stories, different nests of associations and materiality that require constant repetition and a process that requires careful maintenance and repair [33]. To be constantly performed, deployed and redone involves a great deal of work and therefore studying how connections are established, associations done and undone, and how assemblages and facts emerge and are stabilized as outcomes during such a process, is a crucial aspect of the research process.

A diverse range of research has been conducted within the fields of IS, technology study and organizational studies relating to an actor-network style of approach [33–36]. Although as in the case of the differences within CR, we can see how ANT authors may differ in their approach to the study of objects, stability and change. For instance, while Latour focuses on different regimes of truth making and modes of existence, Law and

Mol [37] have concentrated on the development of spatial metaphors and Bowker and Star [38] on standards and boundary objects.[4]

More generally, ANT has been criticized by writers from CR for failing to attend to the broader social structures that influence the local. For Reed [23] and Walsham [40], ANT does not provide appropriate ontological status to structure or agency, and one suggestion involved complementing ANT with the work of Giddens in order to capture the analytical standing of this separable, but interrelated aspect of social reality. While such suggestions provide interesting reflections on ANT, there are certain problems with combining ANT and structural elements in this way given that the structure/agency divide is something that ANT theorists strongly seek to avoid. This is not to say that ANT does not share a keen interest in issues of reality, construction and actions assembling through interactions "elsewhere", but that it provides a very different way of approaching such an idea of action and agency. This difference in relation to questions of structure and agency is exemplified in the ways in which both CR and ANT criticize sociomateriality (SM) with regards to how it portrays the relation between the social and material and bridges the dualist gap between structure and agency. Mutch [9] argues that the influence of Giddens on SM has resulted in the neglect of broader structural influences and the potential to conflate the flexibility of the technological artefact and the interpretive flexibility of agents. In particular, he argues that, "this leads to a downplaying of the material properties of different forms of technology and, in particular, to an underestimation of the degree to which aspects of structure are inscribed into such properties" [9] (p. 508). In contrast to this criticism emanating from CR, researchers from an ANT/Deleuze-inspired stance would present a different ontological view regarding the separation of structure and agency. While they may all agree with the importance of attending to the materiality underlying everyday practice, authors from an ANT perspective would argue that dualisms such as structure/agency, social/material, social/technical, nature/culture, should be viewed as outcomes in a constant process of becoming, rather than as starting points that need additional separation and clarification.

Furthermore, it is interesting how ANT is often positioned as failing to engage with the passions, desires and power relations that underlie the process of "network" building. For instance, Mutch [41] argues that ANT provides a "flat view of human agents, reducing them to effects and denying the embodied, emotional nature of human existence" [41] (p. 487). Although it may be the case that some who have sought to "apply" ANT may have not fully engaged with these aspects in their accounts, a study of different assemblages and encounters in the making should be rich with the different struggles, beliefs, passions and desires that emerge through such a process. Additionally, rather than viewing a human agent as a discrete entity or subject that simply possesses such passions or desires, these passions and desires are seen as emerging through relational encounters of becoming and assembling [41]. This also returns us to an important issue with regards to the shift from the social as something human centred, to the social as a

[4] Internal differences within ANT are apparent such as Mol's criticism of boundary objects for relying too heavily on a more epistemologically based approach and focusing of differing perspectives around the object, rather than multiple realities or ontologies [39].

process of associating and becoming and how this also relates to the work underlying Deleuzian thinking.

Many of the ideas discussed above in relation to ANT connect to the work of the French philosopher Gilles Deleuze. While there is still limited work based on the work of Deleuze within IS and organizational studies, certain authors have increasingly drawn from his work in order to find new ways of re-exploring certain long-standing questions [21, 42, 43]. This body of research has also highlighted the complexity underlying organizational processes and practices and the insights that can be gained through an engagement with Deleuze's work.[5] In this respect, Aroles and McLean [21] have drawn the links between ideas relating to ANT and Deleuzian thinking around the notions of difference and repetition. This includes exploring the difference and dynamism underlying the repetition of organizational practices and engaging with the intensive forces that coalesce through particular events, scripts and different forms of spacing, timing and acting [46, 47]. In particular, by directing our attention to specific matters of concern, truth-making activities, scripts and the intensive forces that underlie the process by which "entities" are repeated into action, it becomes possible to develop a greater sensitivity to both "thingness" and "subjectivity" [48].[6]

How we approach ideas of process, thingness and performativity is therefore key when comparing these approaches to the study of information, technology and organizations. For example, CR seeks to attend to the process of construction through the study of generative mechanisms, tendencies and potentialities that are not yet realized (i.e. the agent and structures possessing certain tendencies are seen as waiting in potential and these tendencies are activated in the production of certain outcomes and effects [22]) and sociomateriality focuses on the sociomaterial dynamics connected to ostensive and performative relations. However, both approaches could be seen to rely to a certain extent on the idea that certain potentialities or tendencies exist in some discrete form with *something* waiting in *potentia* to be realized through further interactions and

[5] Deleuze's work has had a resounding impact on many academic fields by offering new ways of revisiting long-standing questions and interests and challenging two influential "schools of thought" (or streams of thought), namely phenomenology and structuralism. In particular, Deleuzian philosophy is characterized by a systematic attempt to overcome dualistic reasoning and a reliance on *a priori* distinctions (nature/culture, object/subject) and this has involved shifting attention away from being and identity, as the founding blocks of knowledge and towards the concepts of becoming and difference [44, 45].

[6] While this approach attempts to avoid an excessive desire for coherence in which stability and multiplicity cannot easily co-exist or overlap, there are certain additional aspects that also need to be considered in terms of how we view objects in relation to space and time. For instance, the folding of time and space may produce effects of isochrony and isotropy interactions should not be viewed as isotropic or isochronic. Secondly, interactions are not syntopic as it is not possible to view everything from one place (i.e. there are no homogeneous interactions as actions are never carried out by the same material all along). Finally, participants may exert different kinds and quantities of pressures as interactions are not homogeneous or isobaric. This raises the question of how we may understand interactions and shifting agencies which are not always visible in the same time or place, do not exert pressure equally, and can lead to different outcomes in terms of stability and multiplicity [31].

performances. In contrast, rather than viewing things as existing in moments in a progression towards some form of reality, Deleuze [49] argues for a focus on actualized virtualities, rather than realized potentialities. For Delanda, this requires a shift to a non-essential form of realism as true innovation would be impossible if the future is seen to be already given in a modality of time in which previously determined possibilities are realized:

> unlike social constructivism, which achieves openness by making the world depend on human interpretation, Deleuze achieves it by making the world into a creative, complexifying and problematizing cauldron of becoming. Because of their anthropocentrism, constructivist philosophies remain prisoners of what Foucault called "the episteme of man", while Deleuze plunges ahead into a post-humanist future, in which the world has been enriched by a multiplicity of non-human agencies [50] (p. 41).

For Deleuze [51], both the intensive and extensive are real, in the same way that actors rely on networks and vice versa (through a process of localizing the global and redistributing the local). In this regard, the event of actualization therefore never "terminates its connection to the extended and indeterminate world of the undivided virtual Whole" [43] (p. 1493) as the extensive exists alongside the intensive. In other words, while certain forms of extensive outcomes may be experienced or actualized, these are not the product of tendencies awaiting realization depending on desire of social action, nor are they the outcome of a linear chain of construction from tendency to realization. In contrast, within the cauldron of becoming in which relational encounters emerge, a constant and dynamic set of forces rely on the complex folding of intensive and extensive relations that bring together many different spaces, times and actions through various encounters. These encounters can produce different openings and possibilities as they pop up through many different spaces and sets of relations. However, this does not mean that these events subsist in an abyss of chaos and indeterminacy as some foldings, engagement and relational encounters appear more likely, while other resist such assembling. Although we could refer to these processes of assembling in terms of actor-networks, relational encounters or virtual actualizations, what becomes really interesting is how such a focus on the different intensive forces underlying such a process of difference, repetition and morphogenesis can help in avoiding the research process becoming embroiled in a search for originating determinacy, identity, sameness and representation, or lost in a milieu of ambiguity and indeterminacy. We will explore these issues further below as we delve deeper into ideas of ontology and morphogenesis and how these can be seen to overlap and differ in relation to CR and ANT/Deleuzian thinking.

4 Reality, Construction and Morphogenesis

As discussed previously within this paper, both CR and ANT/Deleuze-inspired lines of inquiry seek to challenge approaches that neglect the materiality and embodiness of practices, or that maintain a heavy reliance on traditional realist or idealist approach to the study of IS, technology and organizations. For instance, in response to an increasing shift to a more idealist approach, Fleetwood [8] suggests that within accounts that subordinate entities and facts to merely language, a sense of being or meaning is often

only achieved through language and discursive practices. This then relies on an "ontological claim that discourse, language or some other conceptual or cognitive activity, quite literally, constructs, creates, makes, produces, generates or constitutes entities" [8] (p. 206).[7] For Fleetwood [8], while the ontological turn, from a naive, unsophisticated, empirical and realist ontology to a social constructed one, has placed ontology on the "intellectual radar screen" he suggests that "many people, especially critical realists […] are concerned that current debate is mired in ontological ambiguity – i.e. lack of clarity, imprecision, conceptual slippage and confusion vis-à-vis matters ontological" [8] (p. 198). This also connects to a concern with those approaches that collapse everything into epistemology [53]. As stated by Chia [54] (p. 1483): "Despite the success of Burrell and Morgan's (1979) popularization of ontology and epistemology as core meta-theoretical concerns in organizational analysis, the field of organization theory more broadly has tended to favour the epistemological at the expense of the ontological".

Additionally, Fleetwood [8] argues that rather than seeing entities as transformed from their pre-discursive moments (where they can exist independent of humans) into discursive forms, we need to envisage two states and a set of terms to discuss them (i.e. a reality out there and a constructed reality). However, this form of ontological multiplicity raises an additional problem by extending the issue of ontology in the search for even more beings. In addition to dealing with an essential form of reality, you then amplify this by incorporating a socially constructed one. It is easy to sympathize with Fleetwood's suggestion to reconsider the question of ontology in terms of what "matters". For example, while Chia [54] suggests that it has become commonplace to accept that reality, as we know it, is socially constructed, others may argue with the extent and basis of this claim, not least Fleetwood [8]. Furthermore, Gimenez [55], struggles with such a claim as it reflects the problem of separating the social and material and attempting to restore these links at a later point:

> Once the social has been divided from its material conditions of possibility, they cannot be put together again in thought or interpretation. Recourse to "background conditions" cannot restore the organic connections or internal relations between forms of consciousness, systems of thought (beliefs, interpretations, ideologies), social relations and their material base. This is why, in the end, it all dissolves into beliefs, interpretations, and the like, thus resulting in a "suppose they gave a war and nobody came" view of social change [55] (p. 23).

Rather than separating ontology into two realms or shifting between or along opposing poles (objective/subjective or structure/agency), can we find ways of rethinking ontology that avoid such a separation in this form?

4.1 Morphogenesis and Ontological Commitments

In an attempt to understand and explain organizational life in more detail, we can see how CR and the thinking around morphogenesis seek to delve deeper into our empirical studies by incorporating an appreciation of current and past actions and tendencies. For instance, Archer's concept of morphogenesis seeks to shift our thinking away from stasis

[7] Edwards et al. [52] also support this view with regards to the privileging of language and meaning when exploring the problem of existence.

and towards a relational process of change over time. In doing so, it aims to enable a focus on the material properties of technology, the mechanisms that bring humans into collision with structures that other humans have created and the ways in which technology and structures are located in the broader political economy [9]. For Mutch [9], this includes using a methodological strategy of analytical dualism to separate and hold apart structure and agency in order to explore their interplay over time. Structures are also viewed as virtual for Archer in the sense that they are dependent on human action in the past and present, and also with regards to how certain roles and institutions pre-exist those who come to hold them.

For those researching from an ANT/Deleuzian perspective, such a search for structural mechanisms which give rise to certain forms of potentiality could be viewed as ontologically problematic, as this relies on the coming together of pre-existing generative mechanisms and tendencies that are mediated in relation to human agency. This oscillation between the two (action as determined and action as determining) can also lead to difficult positions, as researchers find themselves constantly shifting between these two poles in the search of sources of action and agency at each level. While those working from an SM approach may attempt to reduce the level of oscillation between the two and bring them closer together, this is seen as a major problem from those working from a CR perspective who feel that the distinction is essentially not clear enough [41]. However, rather than getting into a debate concerning different degrees of structure and agency, perhaps another way to rethink morphogenesis is to focus on the process of becoming through an examination of relational encounters. In other words, by shifting our attention away from objective and subjective poles and a structure/agency dualism, we can focus on the performative and collective sense of action, in a distributed sense, rather than searching for an original source or pre-existing forms.

As within CR, an ANT/Deleuzian approach seeks to find alternative ways of thinking stability and change in terms of space, time and virtuality through the concept of morphogenesis. However, this is a very different view of the virtual and the process of morphogenesis especially given the desire within ANT/Deleuzian thinking [56] to avoid a reliance on generality, representation and identity. In this regard, Deleuzian philosophy shares with Latour an interest in *becoming* as a way of capturing the complex and processual nature of events, actions and practices. Such a stance provides ways of engaging with the multifaceted forces, actions and potentialities that surround everyday practices without relying on pre-established frameworks, structures and/or entities, or on linear notions of causality [57]. In other words, contrary to essentialist approaches that focus on the surface level of extensive forms (i.e. entities), a Deleuzian study of morphogenesis aims to unravel the complexity, heterogeneity and multiplicity that underlie the process of difference and repetition. This involves finding ways of becoming sensitive to the assembling of different intensive forces that easily disappear or are hidden from view in the "actualization" of extensive forms and the intensive spaces of smoothing. Therefore, rather than a "repetition of the same", the focus is on the generative and performative notion of repetition through intensive difference that emerges in creative and novel forms (even if they appear extensively in the image of the same).

Although the intensive domain encapsulates heterogeneous forces, desires and affects, the extensive refers to the homogenous, independent and grid-like forms of

things themselves (e.g. metrics, measurements, goals, etc.). However, the work of intensive difference is often hidden by the extensive properties/qualities that they play a role in generating [58]. Key to the study of morphogenesis in terms of the extensive/intensive relationship is that both co-exist in a complex relational sense; objective and subjective positions are merely temporary moments that may "appear" as extensive outcomes within particular encounters; and while material forces and intensities may assemble from what might be considered the pure past and future expectations, "beings" do not exist "in the past" and in some *a priori* form that then acts on future events. Finally, although continuity may connect many different relational encounters, intensities and material forces behind the scenes, it is not possible to access this in some unmediated sense as different intensive forces may fold and appear through many different relational encounters and in many different spaces.

4.2 A Brief Example of Morphogenesis in Education Research

Within the sphere of primary and secondary education, we can see how a morphogenetic study of performance measurement and accountability based on an ANT/Deleuzian approach could be approached in a different way from a CR perspective. On the one hand, both may provide rich and fascinating accounts of morphogenesis presenting similarities such as: seeking to avoid a traditional realist account of information, knowledge and the practices of management; an engagement with the on-going process of construction that captures a sense of materiality; and methodological approaches that attempt to delve into the details of complex relations and outcomes (e.g. ethnography). However, these studies would not be approached on the same terms given the different conceptual and metaphysical commitments that underlie the alternative versions of morphogenesis. For instance, through a specific focus on becoming and by drawing from the conceptual imagery emanating from an ANT/Deleuzian perspective, an ethnographic study of performance measurement and accountability would seek to explore the constant becoming of relations and assemblages through specific relational encounters and events.

From a CR perspective, a morphogenetic analysis may view certain performance measures (e.g. national standard assessment tests, five A*–C GCSE exam results) and alternative systems and standards (e.g. national curriculum and levels, examination systems, OFSTED, progress algorithms and data measurement, changing approaches to governance and the shift to academies) as structural tendencies and generative mechanisms that become realized in particular forms, within specific contexts. In contrast, from an ANT/Deleuzian approach, the focus would involve an examination of specific relational encounters and events in order to explore the ongoing relationship between intensive forces and extensive outcomes that emerge with regard to the tensions and assembling of various temporalities, spatialities and forms of engagement. This would involve delving into the minutiae of repetition as grounded on difference and the morphogenetic processes underlying the creation of extensive forms and the assemblage of different intensive forces in many different spaces. Thus, rather than assuming the existence of certain tendencies and generative mechanisms waiting in potential to be realized (or not), the focus is on the relationality of assembling in order to explore how

certain facts, practices and outcomes may become stabilized and taken for granted, while other matters of concern and lines of flight emerge (e.g. schools not implementing the English Baccalaureate[8] (EBacc) curriculum when not considered in the best interests of many pupils within the school). For instance, while the attempt to overtly impose the EBacc curriculum onto all schools could be viewed as "resisted", the EBacc has become part of the national school performance measures. This move could be seen as placing a great pressure on schools to ensure their pupils study at least a minimum of five EBacc subjects assuming they wish to compare favourably with other schools in this measure. Furthermore, the grid-like form of goal-directed measures may be viewed as providing objective forms of measurement and a basis around the assessment of attainment and progress. However, rather than something that exists on some macro and structural scale and emerging from the past in some *a priori* sense, exploring various assemblages, tensions and forces enables a focus on how something such as the EBacc is performed through different spaces, times and actions. This requires an in-depth study of how such relational encounters play out through everyday practice and how they may connect many different spacings, timings and forms of actions, as well as different matters of fact and matters of concern [21].

5 Some Concluding Thoughts

There has been a diverse collection of work within the areas of CR and ANT/Deleuze-inspired ontologies that have pulled together a broad range of ideas and contributions and many of these have provided interesting avenues of thought in the study of IS, technology and organizations. In particular, this has included research into construction and reality that seeks to explore a sense of permanence, stability and homogeneity alongside the alterity, mediations and multiplicity underlying such a process. Through a review of different aspects that align and divide CR and ANT/Deleuze-inspired forms of inquiry and a focus on the areas of IS, technology and organizations, this paper has highlighted the desire by both approaches to delve deeper into the complex relations and the multiplicity underlying this relationship. This includes some shared interests relating to ontological concerns (with a greater understanding of how we study objects, the process of becoming and ideas of materiality), epistemological concerns (avoiding a focus on representation in terms of a correspondence theory of truth) and ideas of space and time.

By attending to specific concepts (such as morphogenesis) in further detail, this paper has also sought to highlight important differences that divide these approaches. For instance, in contrast to the work of Archer, a study of morphogenesis from a Deleuzian perspective does not seek to sort out components into temporal cycles or structure and agency dualisms [6] that rely on an *a priori* existence of beings, things and tendencies waiting in potential to be realized. Differing ontologically in how ideas of process, being/becoming, stability/change and ideas of space, time and action are enacted produces

[8] The EBacc is a performance measure used in the UK to assess how many pupils in a school achieve a grade C or above in certain GCSE subjects (set by the DoE).

different outcomes in terms of accounting for the complex relationships aligned to information systems, technology and organizations and how we view different matters of fact and matters of concern [31].

To conclude, within this paper we have sought to review how CR and ANT/Deleuze-inspired lines of inquiry have approached certain metaphysical categories and concepts when examining the complex interrelationships and connections between information, technology and organizations. This has included examining the implications of different ontological and epistemological commitments and how they connect to alternative ideas of stability/change, structure/agency and being and becoming. Finally, this paper prompts our thinking around how we may experiment with more radical forms of empiricism that are more akin to the ideas of William James. For Whitehead [59], this would involve exploring the "becoming of continuity" rather than a convergence on the "continuity of becoming" [59] (pp. 68–69). In particular, this includes becoming attentive to how certain ideas and approaches may rely on a search for "being" and certain *a priori* notions, concepts and divides. This is in contrast to a focus on the process of becoming where our thinking and engagements shift to the complex relations between extensive and intensive forces and assemblages and enables a greater sensitivity to the different and constant process of becoming and repetitions within our organizational and informational worlds.

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Affordance Lost, Affordance Regained, and Affordance Surrendered

The Becoming of Reachability on Social Media Platforms

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Abstract. Informed by the ontology of becoming, this study explores technological affordances in the context of use of social media technologies where multiple human and material agents interact without necessarily being co-present. In such scenarios, tracing the relational configuration of social and material agents becomes a challenge. So far, extant literature based on the ontology of becoming has only considered the actualization of affordances in the proximal co-presence of other people and objects. Extending this understanding of affordances by using actor-network theory (ANT) as a methodological and conceptual device, this research traces translations of the "distant" in the form of inscriptions that can travel across space and time. This study points towards the utility of using ANT, over other interpretive methods, as a tool to study complex technological phenomena. It shows that affordances are collective, ongoing accomplishments of diverse actors, some co-present physically and others, though distant, co-present through translated representations.

Keywords: Affordance · Ontology of becoming · Actor-network theory (ANT) · Co-presence at a distance · Social media

1 Introduction

Interest in the relationship between the social and the material in the context of technologically enabled organizing and social life has intensified over the past few years. Hence, there has been a proliferation of studies that augment, complement, as well as question the received views [1]. Our study attempts to carry forward this thread of enquiry by a commitment to an ontology of becoming [2]. We extend the notion of affordances actualized in the co-presence of multiple human and material agents [3] to scenarios where this co-presence may not be synonymous with physical proximity [4].

While, social media technologies offer features and functionalities which can be appropriately chosen by managers for the benefit of their organizations [5], these features and functionalities are known to, in turn, frame the activities of these managers [6]. As a result of this intertwining, researchers have called for a relook at the artificial separation of the social from the material [7]. The ecological concept of affordance [8] that provides

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for a relational understanding between technology and humans has been lauded as promising to understand the organizational use of information technology [9].

A significant body of research on technological affordances assumes an a priori substantial nature of the social and the material, such that the social agent is the source of action. According to this notion, affordances are actualized when human agency interacts with the materiality of a technology, and in so doing invokes the material agency of that technology [10, 11]. Based on this conceptualization, scholars have tried to understand the actualization of technological affordances in different scenarios, including social media (for example, [12, 13]). This nascent body of work on social media affordances, however, suggests a static character of affordance, where a particular technology affords doing something [14]. However, the actualization of affordances on social media involves "dynamic interactions" among heterogeneous entities, such as human agents in their various capacities, as individual users and as business users, and material agents in the form of technological functions and algorithms.

Recognizing that action and interaction are inherent to affordances [15], another body of work has developed based on the ontology of becoming [2] that conceptualizes affordances as ongoing accomplishments [3]. This literature has explored the actualization of affordances when multiple human and material agents are proximally co-present, resulting in "cascades of affordances". Here a contraption of social and material agents actualizes the affordance [16] through sequential or iterative enactments. Accordingly, "affordances" of technological objects cannot be easily separated from the arrangements that are performatively realized in practice [3]. These arrangements are nothing but processes of ongoing becoming called assemblages [2]. Assemblages are not complete "things" possessing a priori primary qualities. Rather, their qualities are emergent accomplishments of ongoing flows and movements.

In this study, we present our findings with regard to one particular affordance in the context of use of Facebook, an extra-organizational social media platform, by a firm for the purpose of branding and marketing communication. Informed by the ontology of becoming, we set out to trace the ontological history of an affordance [2]. However, we soon realized that the various agents that performatively enacted the affordance were not proximally co-present [16]. It, therefore, became a challenge to trace the relational constitution of the affordance. For example, when Facebook affords association between two individual users, those users are not co-present in the same space or time. However, they are co-present, while at a distance [4], in the form of their representations on the social media platform, such as their profile information and the content that they created on the platform. In order to deal with co-presence while at a distance, we resorted to actor-network theory (ANT), which, through its methodological and theoretical premises, provided us the language and the means to trace the flow of becoming of a heterogeneous assemblage, enabled to afford a particular action. We were, hence, able to "follow the actors" [17] on scene, and trace mobile agents that represented their intra-actions. In so doing, we illustrate the utility of ANT, over other interpretive methods, in understanding affordances as a collective accomplishment of diverse actors, some co-present physically and others co-present while at a distance.

This paper is organized according to the following scheme. We first present the theoretical background, followed by the research context. Thereafter, we elucidate the methodology and present our findings. Subsequently, we provide a detailed discussion and conclusion.

2 Theoretical Background

2.1 Co-presence and the Becoming of Affordances

The theory of affordance, rooted in the area of Ecological Psychology, posits affordances as complementarities between the animal and the environment [8]. By pertaining to both the environment and the observer, affordances go beyond the objective by expressing environmental attributes relative to humans, and go beyond the subject by describing meaning relative to the objective world [15]. Due to the ability of the concept of affordance to overcome the objective–subjective divide, it has been proposed that this concept might assist in better understanding organizational use of information technology (IT) [9].

Literature on technological affordance in the domain of Information Systems (IS) describes affordance as the possibility for goal-oriented action made available to a user by the technology [18]. Affordances are unlike properties of the technical artifact, since affordances are relational in nature, pertaining both to the people who use the technology, as well as the materiality of the technology itself [11]. For example, the affordance of visibility [12], that is making information about oneself visible to other users on Facebook, is actualized through the invocation of the material features of the Facebook interface by a Facebook user. Here, visibility is an affordance, and not a property of Facebook that exists independent of the user.

There seem to have developed two distinct conceptualizations of the notion of affordance, especially with respect to the ontological status of an affordance. The first conceptualization assumes that affordances are realized in a gradual imbrication of distinct social agencies with material agencies, which further leads to their overlap and subsequent interdependent function [13, 19, 20]. However, the artificial separation between the social and the material seems to have been reinforced by this body of literature. Furthermore, this literature espouses a static notion of affordance where a technological object affords certain action [14]. The artificial divide and the static notion of affordance are especially problematic for the study of social media contexts where the social and the material interact and are fundamentally co-constitutive [21]. Departing from the notion of affordances based on a “distinct irreducible character” of agents, an alternative conceptualization bases the notion of affordance on the ontology of becoming [2, 3, 14]. This requires a shift from the understanding that a being offers affordances, to an alternate understanding where becoming enabled to afford a particular action is an ongoing accomplishment of a heterogeneous assemblage [2]. This assemblage is a framing of ontological openness. This implies that the assemblage does not possess any a priori primary and secondary qualities, such that any change only happens in the secondary properties. Rather, there exists no boundary between primary and secondary qualities, and all changes affect the primary qualities of the assemblage. Thus, all

qualities emerge in ongoing flows and movements. Hence, according to the ontology of becoming, affordances are "dynamic" [14], since they do not pre-exist, but emerge only in action.

Furthermore, the former conceptualization assumes a dyadic notion of affordance where an affordance is actualized in the relationship between an individual user and a technological artifact. Again, such an understanding restricts the explanation of affordances actualized in the presence of multiple people and objects [3]. For example, Facebook also affords a user to associate [12] with another user on the network, where the affordance to associate is not actualized between an individual user and the technological platform, but between multiple users. Here too, the latter conceptualization of affordance allows for a conceptualization involving co-present people and objects that collectively accomplish an affordance [3]. Michael [16] proposes the concept of "cascades of affordances" to understand the actualization of affordances in the co-presence of multiple actors. For example, the affordance of walkability on snow is explained as: socks affording easier wearing of boots which afford attachment of crampons which afford climbing snow-covered slopes [16]. However, in the example of the affordance to associate on social network, the two users are not co-present. Hence, this scenario is not akin to a "cascade of affordances" where a contraption of proximally situated social and material agents actualizes the affordance (cf. [3]). Instead, we observe that spatially and temporally distanced users collectively intra-act with the materiality of Facebook to ontologically constitute themselves as "friends" on Facebook.

Complex technological environments, such as social media, often lack co-presence of their users, and their material feature and algorithms. For example, Twitter's Trends algorithm identifies topics of interest for a user by accounting for the actions of thousands of users who lack co-presence with this particular user. With the proliferation of such phenomena, exploring the actualization of affordances where co-presence is not a necessary condition can help in making better sense of organizing.

2.2 Following the Absently Present Actors

It is clear that tracing intra-actions among heterogeneous agents that might not be co-present is crucial to understanding the becoming of affordances on social media. Social media may be described as a virtual space-time where people engage without "bodily co-presence" [4]. However, for us the challenge lay in accounting for the invisible but present [22] entities inhabiting the scene and the consequences thereof. On social media, it may be observed that the absent become present in the form of "contrivances" that allow translation without corruption [23]. Here, translation implies the possibility that one thing may stand for another [24]. For example, users' profile pages stand for individual users, users' posts stand for their views, users' "likes" on other users' posts stand for their interests, and so on. Taking a cue from the existence of such translations, we resorted to ANT that suggests "following the actors" as they construct a network of point-to-point connections that are made of traces left behind by some moving agent [17]. These moving agents are, what Latour [23] calls, inscriptions that render the traces mobile and immutable. However, inscriptions also "bracket away" the relationships between actors, foregrounding some details and suppressing many others relating to

events and contingencies involved in their production [25]. On social media, the physically absent gains presence [26] through the translation of inscriptions, such that distant exchanges seem co-present. For example, when a user "comments" on a post by another user on Facebook, even though the local contingencies contributing to the user's comment are suppressed, this comment gets inscribed into the materiality of the interface, travelling across space and time, to constitute a conversation between the two users co-present while at a distance [4]. In this way, the inscribed "comment" is delegated the action of the user [23], such that the user becomes absently present through the comment [22]. Furthermore, these inscriptions can be superimposed, reshuffled, recombined, and summarized [23], thereby becoming translations that can travel across space and time, mediating the relationship between heterogeneous entities, and in so doing relationally defining them [24]. Going back to the previous example, the materially inscribed conversation relationally defines the two users as partners in the same conversation. Further, multiple such conversations emanating in the form of "comments" on the same post can be summarized to indicate that the post relates to a topic of interest to a wider Facebook audience, such that the users who commented on the post get relationally defined as sharing that interest.

3 Research Context

In this paper we present the findings from our fieldwork at a firm, henceforth referred to as OMEGA, founded in mid-2012 as an online retail store dealing in accessory solutions across different lifestyle segments, and catering to Indian customers. Owing to the rising adoption of smartphones in India,[1] the company discontinued sale of all other accessories and solely entered the category of smartphone cases in January 2014. The founders of OMEGA positioned designer and customizable cases as a means of improving the "look" of the smartphone. They aspired to make such cases a medium of personal expression, not merely a means of protecting the fragile body and screen of the smartphone. The company tied up with renowned designers from across the world through exclusive contracts to offer around 2,000 designs for cases across 105 smartphone models. As of mid-2015, the company had sold more than 120,000 smartphone cases.

OMEGA was solely dependent on online channels for promoting its brand, and social media platforms were considered most potent in allowing direct connection with existing as well as potential customers. The firm is active on each of Facebook, Twitter, Instagram, and Pinterest. During our fieldwork, the company reported spending approximately 70% of its total budget on social media marketing, with Facebook accounting for close to 90% of this spending. OMEGA had also set up a brand *Page* on Facebook, a facility that enabled it to connect and interact with interested Facebook users without having to pay Facebook.

At the time we began our research, the company extensively used its brand *Page* to interact with Facebook users. But, our initial interviews with the employees of the

[1] See [40].

company revealed a rising sense of wariness towards the benefit of posting content on its *Page*, due to changes in Facebook's algorithms that governed which users saw its posts. We felt that this flux in situation was an interesting starting point to enquire how an extra-organizational technology could enable and constrain businesses. Our fieldwork revealed that the wariness reported initially was not long-lasting, with distinct phases of ebb and flow in OMEGA's confidence with respect to using Facebook for branding and marketing communication. Our study traces these variations, and illustrates that this undulation was an outcome of not just the changes in Facebook's algorithms, but also the intentions and continuous doings of OMEGA's marketers, Facebook's managers, and Facebook users.

4 Methodology

Before delving into the field, a preliminary background research was conducted in order to gain insights into the practices and concerns of firms that primarily use e-commerce as their mode of transactions. Approximately twenty informal interactions conducted in-person and telephonically helped us realize that, while the firms' accomplishments ostensibly appeared to be results of organizational practices, they were in fact the result of actions performed by a gamut of heterogeneous human and non-human agents. The recurrence of non-human agents in our context motivated us to choose actor-network theory as a method for data collection and subsequent data analysis. Being both a theory and a methodological approach [17], ANT provided us with theoretical concepts, as well as suggestions on carrying out empirical work [27].

4.1 Method

ANT accepts that both human and non-human actors can be the origin of actions [28], and agency is a privilege of not only humans, but, also non-humans, inanimate objects and artifacts [29, 30]. These tenets were especially useful for us as we delved into a field replete with human and material agents. Drawing on ANT, we followed the various actors through their work, examining their diverse positions, controversies and outcomes [31]. Interviews gave us the wherewithal to travel across space and time [32] to collect accounts on current and past intra-actions of the organizational human actors with technological artifacts. As we had expected, from the very beginning we encountered a heterogeneous cache of non-human agents including websites, blogs, software, algorithms, and artifacts. In the case of social media, prior research has found it challenging to empirically investigate software and algorithmic agents due to non-disclosure of details about them [33]. Employing ANT, we were able to follow these new actors on the scene by exploring websites, online user manuals and help pages, publicly available online articles, and developers' documentation. The prior training and experience of the researchers in technology assisted in making sense of the collected artifacts as we delved deeper into the technical aspects of the technical agents. In following the actors, a network of relations

started emerging between these heterogeneous elements and we started tracing the intra-actions that represented the work being performed in this network [34].

4.2 Data

This study is based on data collected from April 2015 to April 2016. Since the focal firm, OMEGA, is located in a different geographical region from the university where the authors are stationed, one of the authors made three trips, of three weeks, five weeks, and four weeks duration respectively, for the purpose of data collection to the region where the firm is located. Interviews, informal discussions, and observation of the day-to-day practices of employees of the company were used for data collection on-site. In addition to the two co-founders and personnel responsible for marketing, operations, and technology functions, the author also interacted with various other employees and visited the site on multiple occasions to observe and understand the workings of various teams. The author revealed her identity as a researcher and the purpose of her research to each member of the firm with whom she interacted, reassuring that anonymity will be maintained and no comments will be attributed to them in any subsequent discussions or reporting [35]. Most interviews were conducted either on-site or telephonically in a semi-structured fashion. The average duration of an interview was approximately 90 min. After seeking due permission from the interviewees, all but three interviews were digitally recorded. Details of the interviews that were conducted are presented in Table 1. Notes were taken for the interviews that were not recorded. The author transcribed most interviews verbatim. A record of multiple interactions over e-mail and instant messenger, mainly dealing with clarification of doubts and gathering statistical information from the informants, also formed part of the data corpus. Furthermore, the author maintained a research diary to make note of her informal interactions with the employees and keep records of her observations on-site.

Interviews with OMEGA's personnel revealed that they often referred to a plethora of official blogs, articles, and online help pages to better utilize the possibilities offered by social media. In the spirit of ANT we followed these traces to access publicly

Table 1. Details of interviews at OMEGA

Informant	Number of interviews	Interview duration (hrs)	Recorded
Co-founder & Chief Executive Officer (CEO)	3 (1 telephonic)	4.5	Yes (1 telephonic not recorded)
Co-founder & Chief Operating Officer (COO)	1	1	No
Manager (Marketing & Strategy)	3 (2 telephonic)	5	Yes (1 telephonic not recorded)
Category Manager	1	2.5	Yes
Tech Lead	1	1.5	Yes

Table 2. Indicative list of web resources

Webpage/blog	URL	Content description
Facebook for Business	www.facebook.com/business/	Latest news, tips and best practices for businesses who use Facebook
Facebook Newsroom	newsroom.fb.com/	Information and news about Facebook, its products, its investors, etc.
Facebook for Developers	developers.facebook.com/blog	Product documentation, tools and support for Facebook's APIs
Facebook Help Center	www.facebook.com/help/	Support for individual and commercial Facebook users
Jon Loomer for Advanced Facebook Marketers	www.jonloomer.com/	Marketing tactics for Facebook
TechCrunch	techcrunch.com/	Technology industry news

available digital artifacts over the Internet. While providing an exhaustive list of online resources used is not possible due to space constraints, an indicative list of these artifacts is presented in Table 2.

4.3 Analysis

OMEGA used social media for varied purposes including advertising, branding, and marketing communication. In this paper we restrict our findings to those pertaining to branding and marketing communication. We started off with the preconception that social media as a technology would afford, that is, allow and forbid, certain actions by those who act on it [36]. However, in following one actor after another and tracing their interrelationships, we understood that most of the actors that we were following, along with their practices, constituted what we had black boxed [32] as "social media". Opening this black box to unravel nuances about organizational practices helped us in foregrounding the multiple intra-actions between entities, such as individual Facebook users, personnel at OMEGA, OMEGA's competitors, managers at Facebook Inc., and algorithms, which were essential to the becoming of the socio-technical assemblage being traced. We realized that many of the entities of interest to us were physically absent from the scene, but were notionally present. By invoking the conceptual categories of *absent presence* [22] and *translation* [24], we were able to trace the ontological history [2] of one particular affordance that we tracked.

5 Findings

5.1 Reachability: The Becoming of an Affordance

The niche nature of OMEGA's product required pushing information to potentially interested audiences to spread awareness about its offerings. Even though display

networks allowed marketers at OMEGA to place ads on websites where potentially interested audiences were likely to visit, these ads appeared as nothing but a distraction to the visitors. As an alternative, the marketers decided to utilize social media's affordance to reach out to potentially interested audiences, through branding and marketing content, in a manner that did not strike as disturbing.

> In social media it is different. Here you reach out to a user who is not expecting your ad, but you [can] show things very nicely to him. So he gets to know about your service.

OMEGA's Facebook brand *Page* proved to be an especially useful medium to organically reach out to potentially interested Facebook users. Organically reaching out implies that content posted on OMEGA's *Page*, unlike ads, can be made to appear in the News Feed of Facebook users without paying Facebook. News Feed is described on the Facebook Help Center[2] as follows:

> News Feed is the constantly updating list of stories in the middle of your home page. News Feed includes status updates, photos, videos, links, app activity and likes from people, *Pages* and groups that you follow on Facebook.

Facebook users can follow a brand *Page*, by clicking on a "Like" button provided by Facebook's materiality on the *Page*, thereby explicitly showing interest in being served content posted on the *Page* in their News Feeds. As of mid-2015, OMEGA's *Page* had close to 400,000 followers. This implied that not only could OMEGA reach out to this large population of Facebook users organically, but also non-obtrusively through a native display of visual content using features provided by the interface. As a result, OMEGA's *Page* posts usually consisted of images depicting its products and services, which were then served in the News Feed of OMEGA's followers.

> [Facebook is] a place where customers and others can interact with us, plus they get to know about our services – when we post … [I]t is a very visually strong medium, where if photos are shared, they show big in size and are displayed natively [in the News Feed], they are part of the experience … The Facebook inventory is very strong visually, so it is best for us.

In this way, marketers at OMEGA constituted themselves as business users of the social network by invoking Facebook's material agency to set up a Facebook *Page*. Similarly, when individual Facebook users invoked Facebook's material agency to "Like" OMEGA's *Page*, they were able to re-constitute themselves as OMEGA's *Page* followers, in addition to being Facebook users. In this relational re-constitution of Facebook users into OMEGA's followers, these followers got mobilized to be absently present [22] as allies of OMEGA, to whom content created by OMEGA's marketers may be pushed by Facebook's material agency in future. The re-constitution of OMEGA's marketers and its *Page* followers is a relational effect [24] of the interactions that these actors have with Facebook's materiality. The establishment of these point-to-point connections allows Facebook's algorithms to send mobile agents [17] in the form of Facebook posts created by OMEGA's marketers to its thousands of absently present followers. Even though these circulating *Page* posts "bracket away" all the local contingencies of their production [25], they allow OMEGA's marketers and its followers to

[2] See [41].

become co-present while at a distance [4]. We define OMEGA's ability to reach potentially interested audiences with *Page* posts as the affordance of reachability. This affordance is not actualized by the physical "co-presence" [16] of other people and other objects [cf. 3], but by the translation of other actors in the form of inscription across space and time [23], that then become co-present through these representations.

Hence, reachability is actualized not in the interaction between OMEGA's marketers and Facebook's materiality [15], but is accomplished in the multiple intra-actions among heterogeneous actors constituting an assemblage. This assemblage does not possess a pre-existing reachability, but in the multiple intra-actions, becomes performatively enabled to "reach". For example, Facebook users transform into *Page* followers by intra-acting with the material feature provided by Facebook; OMEGA's marketers utilize Facebook's materiality to post visual content to their *Page*; and this content gets pushed to the News Feed of OMEGA's *Page* followers. Here, agency exercised does not belong to a single actor or a set of actors, but intra-actions among heterogeneous actors, their flows and movements, collectively contribute to the becoming of an assemblage enabled to reach potentially interested audiences [2].

5.2 Affordance Lost: Fragility of Assemblage

The initial experience of OMEGA's marketers was that posts made on its *Page* reached the News Feed of most of its followers. However, over time the number of people that OMEGA could organically reach started declining. The marketers attributed this to a change in the way that Facebook served the News Feed.

> On Facebook, the reach has been restricted. If I have 3 hundred thousand followers and I make a post on the *Page*, it will reach only 2,000–3,000 people … It's based on relevance – who will be the people interested in reading your post.

A marketer at OMEGA informed us that in an article in "Facebook for business" the lead of the Ads Product Marketing team of Facebook[3] had explained two reasons for declining organic reach. When we accessed the article dated 5 June 2014, we found that the first reason related to increasing competition for space in users' News Feeds, and the second was regarding the filtering of content shown to users by the News Feed algorithm:

> The first reason involves a simple fact: More and more content is being created and shared every day … On average, there are 1,500 stories that could appear in a person's News Feed each time they log onto Facebook … In addition to the growth in content, people are also liking more *Pages* … With each new *Page* like, competition in News Feed increases even further … The second reason involves how News Feed works. Rather than showing people all possible content, News Feed is designed to show each person on Facebook the content that's most relevant to them. Of the 1,500+ stories a person might see whenever they log onto Facebook, News Feed displays approximately 300. To choose which stories to show, News Feed ranks each possible story (from more to less important) by looking at thousands of factors relative to each person.

The News Feed algorithm constitutes the materiality [7] of Facebook and is coded to decide which content to serve to whom [37]. As is evident in the above quote, the

[3] Source: [42].

algorithm is designed to calculate the relevance of each post created by a business/individual user, for every other user. By performing these calculations and serving content accordingly, the algorithm re-configures the connections that relationally define individual users and marketers. This can be illustrated through the long lag between the change in Facebook's algorithm (implemented some time in 2013)[4] and OMEGA experiencing a decline in reach (in early to mid-2015). The competition for space in a *Page* follower's News Feeds, mutually defines the follower in relation to OMEGA. Importantly, it also defines OMEGA in relation to its competitors, who are absently present [22] in the form of their circulating posts and ads. As competition intensified over time, the filtering of posts based on relevance by the News Feed algorithm led to many of OMEGA's followers not receiving its posts. Hence, OMEGA ceased to be co-present, even at a distance [4], for these followers. The intra-actions among competing advertisers, and between advertisers and the News Feed algorithm through mediating advertisers' posts, collectively reconstituted the flow of becoming of the heterogeneous assemblage that did not inherently lack the affordance of reachability, but in the establishment of a relational configuration, became enabled to "constrain reach". Hence, OMEGA's ability to reach out to interested Facebook users through unpaid *Page* posts got restricted, explicating the essential fragility of the heterogeneous assemblage [3]. In this way, the affordance of reachability is lost, as OMEGA fails to be co-present with its followers.

5.3 Affordance Regained: Collective Reconstitution of Assemblage

The prior experience of OMEGA's marketers on Facebook revealed that *Page* posts, to which interested Facebook users could relate to, were shared by these users more often than other posts with mundane content. Sharing of content was a feature made available by Facebook that enabled a user to share specific content with his or her friends on Facebook. As a result, OMEGA's management decided to leverage the artwork that they received for printing on cases for smartphones from the renowned designers with whom OMEGA had exclusive contracts. Furthermore, OMEGA tied up with bloggers specializing in photography to post content for them.

> We don't use photoshopped images now. We have tied up with 10 photo bloggers and made them post for us. Recently we [also] decided that, since we are a design focused company, so we should use our artwork. So we allow that to be shared on Facebook, and they get so many shares.

Photographs and artwork, therefore, became mobile agents that could pass through the connections [17] between designers/photo-bloggers and OMEGA, and between OMEGA and its followers on Facebook. By sharing such content with other Facebook users, the followers of OMEGA enabled the co-presence of OMEGA while at a distance [4] with these other users as well. Similarly, when a Facebook user responded to a *Page* post by OMEGA by clicking on the "like" button next to it, the post might get served to other Facebook users in the network of this user. As explained earlier, the News Feed

[4] See [43].

algorithm served this post to these other users based on its relevance to them and competition in their News Feeds. All this work being performed in the actor-network led to redefinition of OMEGA in relation to Facebook users who were not its followers, thereby extending its reach beyond its follower base.

> A post will go first of all to the News Feed of the people who Like our *Page*, but, it will go [only] to around 2% of those people, because Facebook has limited the reach. Then supposing someone likes it, then it will be shown to his friends. These will be [either] those who have maybe liked the brand *Page*, or may not have liked it. So, that ways the reach keeps increasing. The probability [of the post reaching News Feed] is more for people who engage with the posts of this person. It's based on relevance … those will be the people who keep interacting with [this individual] on [her] Facebook posts … We try to have posts that people can like and share.

By taking advantage of the intra-actions between Facebook's materiality and Facebook users when they respond to posts, OMEGA's marketers were able to delegate some of their work to their followers [38]; that of putting agents, in the form of posts, into circulation through connections in the network. The intra-actions between OMEGA and its followers, and OMEGA's followers and their friends, collectively reconstituted the heterogeneous assemblage. Becoming enabled to "reach" was an ongoing accomplishment [2] for this assemblage through the intra-actions between OMEGA and its followers, and among the followers and their friends. Hence, the relational configuration that affords reachability was regained.

5.4 Surrendered Affordance: Assemblage Becoming Non-existent

The competition for space in the News Feed of Facebook users has been increasing, and most firms that maintain brand *Pages* on Facebook are experiencing a decline in the organic reach of their posts. This declining reach has become a hot topic of debate among various experts[5] who are trying to understand the impact of this decline on businesses. A marketer at OMEGA quoted one such report[6] by a team of social experts, social@Oglivy, to explain that despite all their efforts, the organic reach for OMEGA's posts has been declining further:

> Facebook's organic reach is constantly decreasing. It [is said to have] fallen from 16% in 2012 to only 2% in 2014. Some say it is lesser than 1%. This constant decrease has also popularized a term called "Facebook Zero" where brands are already getting prepared for the day when the organic reach falls to zero. On an average our last 5 organic posts' reach has been 0.31%.

Owing to the sharp decline in reach, marketers at OMEGA started paying Facebook for having *Page* content exposed to more users than was otherwise served by the News Feed algorithm. This feature, called boosting, is available to *Page* owners, and is explained by Facebook[7] as follows:

> Boosting posts is an effective and inexpensive way to get more exposure for your content. It's a simple and easy process – posts are boosted right from your Facebook *Page* – and you can

[5] See, for example, [43, 44].
[6] See [43].
[7] See [45].

> boost a post for any amount you want … It's a great way to get more people to see your posts, promote special events, offers and news, and to reach new audiences through targeting.

While marketers at OMEGA circulated payments to Facebook as another element to ensure its co-presence while at a distance with individual Facebook users, paying for reach was counter to the logic of unpaid organic reach. Over time, marketers at OMEGA saw little value in posting content on its *Page*. Our data revealed that the number of *Page* posts made by marketers at OMEGA almost halved by the end of 2015 in comparison to the beginning of the year. Figure 1 depicts the quarter-wise trend of the number of *Page* posts by OMEGA on Facebook.

As marketers at OMEGA withdrew from Facebook, they started looking for other mediums where they could organically reach out to potentially interested customers. In other words, marketers at OMEGA started exploring other means to be co-present with interested audiences on the Internet.

> Most posts with more than 100 engagements are boosted. The organic reach on Facebook has almost reached zero. The posts are not reaching people, so we have to boost [most of the posts]. That is why we are shifting to Instagram now. That is doing very well for us. We are also using Pinterest … The total number of posts on Facebook are declining now, because we are not investing much on Facebook. The returns here are quite less. We are trying to shift to other mediums. In fact nowadays, I am trying to find ways of getting engagement on different channels without any payment.

In this way, OMEGA stopped circulating moving agents through the connections that linked it to its followers on Facebook, the affordance of reachability on Facebook was surrendered, and the heterogeneous assemblage dissolved into non-existence. In other words, with the decline in intra-actions among the actors constituting the heterogeneous assemblage, the becoming of the affordance of reachability was stalled. OMEGA's marketers started looking for new allies on other social media platforms, establishing new relationships, and attempting co-presence while at a distance outside this heterogeneous assemblage.

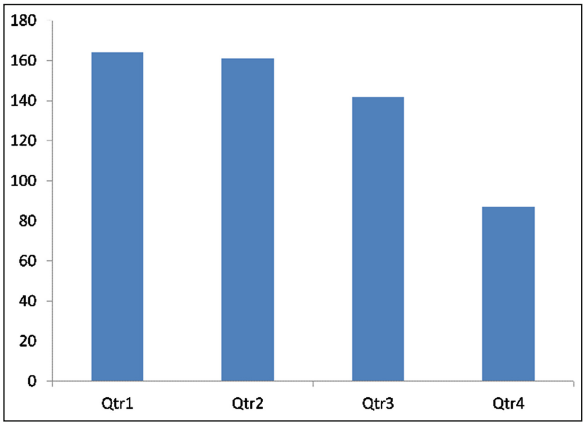

Fig. 1. Quarter-wise number of *Page* posts by OMEGA in 2015

6 Discussion and Conclusion

In this research we adopt a process view of affordances, rather than affordances being the end state [3]. We illustrate the process of becoming of the affordance of reachability on Facebook through multiple intra-actions among heterogeneous agents [2]. We follow Bloomfield et al. [3] in graduating from a dyadic notion of affordance, between a human agent and a material artifact [3], to a notion involving the co-presence of multiple actors [16]. However, the conceptualization of affordance discussed herein is distinct on two fronts. Firstly, the notion of co-presence espoused in extant literature (cf. [3, 16]) assumes the physical co-presence of different actors. For example, when socks afford easier wearing of boots, which afford attaching crampons, which afford walking on a snow-clad slope [16], the socks, boots, crampons, and snow-clad slopes have to be physically present in close proximity to allow the affordance of walkability on snow. In contrast, on Facebook, the marketers, individual users, Facebook's algorithms, Facebook's material features, and circulating posts and ads, are all dispersed in space and time. However, through certain configurations of the heterogeneous assemblage relationally constituted by the intra-actions among these actors, the physically absent gains presence [26]. This co-presence while at a distance [4] is achieved through the translation of the distant in the form of mobile artifacts [23], such as *Page* posts created by a firm or shared by its followers. Secondly, counter to the example of walkability on snow, the becoming of an affordance discussed here is not a simple cascade of affordances [16], one leading to another. Rather, in this case, agency flows in all directions [2]. *Page* followers and OMEGA get defined in terms of each other, through the actions of Facebook's algorithms which compute the relevance of OMEGA's content for its followers, in comparison with the content produced by OMEGA's competitors. Further, when OMEGA's followers share OMEGA's *Page* posts with their friends on Facebook, they alter the relational definition of OMEGA. The becoming of the affordance of reachability is, therefore, contingent upon the collective enactment of all these intra-actions.

ANT, which follows a relational and process-oriented ontology [24], allows us to foreground the intra-actions that constitutively define the relationality of an affordance, even when co-presence is from a distance [4]. Extant research that takes a process-based view of affordances is largely based on interpretive methods that do not allow exploring the relationships that performatively configure an affordance while co-presence is at a distance (see, for example, [3] for an ethnographic account, [14] for a multi-case account). On the contrary, ANT allows empirically following the establishment of point-to-point connections between actors through the traces left behind by agents moving through these connections [17]. These traces allow bringing back of distant people, places, and events [32] to a point where they can be absently present [22]. Furthermore, it suggests reality to be a relational effect such that it is produced and stabilized in interactions that are simultaneously material and social [39]. The strength of ANT to transcend the divide between the macro-social and micro-social [24] allowed us to observe the multiple intra-actions among OMEGA's marketers, individual Facebook users, other firms, Facebook's algorithms and materiality, and circulating posts and ads, that contributed to the becoming of one particular social media affordance.

Through this paper we try to illustrate the usefulness of ANT as a method to study complex socio-material phenomena characterized by entities that cannot be pre-ordained as social or material, partaking in the becoming of the socio-material assemblage. Though we begin by imposing an ontological division between the "social" and "material", this boundary is imposed not for relegating to a bifurcated being ontology, but is imposed purely for analytical purposes. For example, despite these ontological boundaries, we trace how OMEGA's followers get relationally redefined when they start receiving its competitors' posts, and how the relational configuration of the affordance of reachability undergoes a change for OMEGA. This ontological openness implies that all qualities are emergent to the becoming of any particular being, and that assemblages are never complete "things", but are "processes of ongoing becoming in order to achieve certain accomplishments" [2] (p. 333).

In conclusion, this paper tries to go beyond the conceptualization of affordances actualized in the proximal co-presence of other agents (cf. [3]), by exploring a social media scenario where co-presence is from a distance. By using ANT, we trace the relationality that is implicit in the becoming of affordances [2] in such scenarios. We hope that this study will highlight the advantage of using ANT as a lens, over other interpretive approaches, for understanding complex technological scenarios involving diverse agents, often physically absent but notionally present [23].

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Exploring Affect and Affordance

Ideological Materiality at Work: A Lacanian Approach

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Abstract. While recent theoretical debates have foregrounded sociomaterial studies and the interpenetration between the social and the material, practice-based studies have neglected, if not omitted, the place of affect and ideology in work practice. The use of the notion of materiality causes a conflation of different ontological claims, and a conceptual clarification is needed to grasp the polysemy of materiality. This paper provides some key notions for those interested in addressing the materiality of the affective register at work. By drawing on authors such as Lacan, Althusser, Butler and the Essex Lacanian School, this paper suggests that much is to be gained by addressing two difficult but crucial notions: the materiality of the signifier and ideological fantasy.

Keywords: Materiality · Ideology

1 Introduction

The key word of this conference is of course "beyond"; what is problematic is not so much the validity or obsolescence of interpretive studies in information systems (IS), but rather the difficulty of initiating new debates within the interpretive scope. Interpretivism, the research avenue which sees knowledge of reality as a social construction and states that value-free data cannot be obtained, stands in stark contrast with positivist studies, where "objective" data can be used to test a prior hypothesis (Walsham [1]). Although our field absolutely needs an interpretive label externally to define itself vis-à-vis positivist studies, it also requires a minimal internal flexibility to facilitate a lively debate regarding its own ontological, epistemological and methodological presuppositions. For instance, Klein and Myers [2] identify hermeneutics as the main form of interpretivism, acknowledging that postmodernism and deconstructionism are fundamentally different forms. Furthermore, IS research, different from both positivist and interpretivist research, can also be classified as critical [3]. Critical research signifies research in which social critique constitutes the main task, which means bringing to light the restrictive and alienating conditions of the status quo [2]. Critical research is emancipatory [4] and assumes that people, including the researcher, can consciously act to change their social and economic conditions.

In this paper I would particularly like to explore the potential of process theorizing, which means a mode of theorizing which is not merely about interpreting its object (technology in organizations), but thinks beyond its object [5], with the value of a critical

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intervention. More specifically, the aim of this paper is to reinvigorate the debate about the meaning of materiality. Shall we complement the corpus of sociomaterial studies with a suitable framework to think beyond interpretivism and study the materiality of the affective register? What are the notions which would gain currency from an ideological critique of work practices? The main contribution of this paper is to complement existing accounts of ideology in the literature of technology in organizations by introducing the notion of the "materiality of the signifier" and "ideological fantasy" to complement and enrich existing sociomaterial studies.

The paper is organized as follows. Firstly, language and materiality will be posited as the two poles of this debate, with sociomateriality as a dominant way of over-coming this opposition. Secondly, this paper will highlight the deficits of the materiality of the affective register in existing accounts of sociomaterial studies. The traditional articulation between the social and the material indeed conceals another articulation between the affective and the discursive. Finally, this paper will draw on authors such as Lacan, Althusser and Butler and the Essex Lacanian School (Laclau, Glynos) to propose a radical approach and to provide an adequate language for those researchers seeking to grasp the articulation of the affective and the discursive.

2 Language and Materiality

Technology, as well as its design and use, is not merely functional but also the product and subject of language. Thus, debates on the relationship between discourse and materiality highlight the plenum of agencies associated with technology.

As a response to deterministic positivist studies conferring materiality with a strong causal force, interpretive studies emerged in the 1970s and 1980s with a different agenda, focusing more attentively on social dynamics, the social context and human aspects, and on why people and organizations respond differently to computers. Language and materiality typically become the two poles of these debates. After the linguistic turn which occurred in the social sciences, following the influence of Wittgenstein, the structuralist linguist Saussure and subsequently Derrida, linguistic methods have progressively penetrated into the field of organizational studies [6] in response to the hegemony of positivist studies in management research. These studies tend to address issues such as communication or discourse themselves, as distinct from materiality.

However, communicative, discursive or linguistic explanations have been accused of "exaggerating the muscle of symbolism" [7] (p. 24). Post-structuralist thinking is typically reduced by orthodox Marxists, positivists, critical realists or actor-network theorists to a fashionable form of linguistic idealism, naively fascinated by the "free play of signifiers" [8] (p. 125) and abstractly disconnected from materiality. At the other end of the spectrum, neo-materialist thinkers such as Latour, in open dispute with the linguistic turn [9], accuse this linguistic idealism (also known as postmodernism) of having marginalized objects. Latour is the architect of the hybridation of the social, the discursive and the material. A way for him to cut the Gordian knot between the three was to coin the hybrid notion of "quasi-objects", drawing on the work of Michel Serres. Such studies progressively cohered and paved the way for the theoretical movement of

social constructivism in the 1990s, a movement which can be divided into two streams [10]. The first is the field of science and technology studies (STS), which examines the social processes during the design and development process [11–14] From this perspective, interpretivism leads researchers to research themselves and critically assess the assumptions and theoretical constructs underlying their scientific discipline and practice [1]. The second stream, the field of organizational and information studies, studies technology's implementation in organizational contexts, drawing heavily on Giddens' structuration theory [15–17].

How is the notion of materiality applied to the context of work? Various researchers have attempted to connect discourse and materiality in order to materialize organizational communication through the lens of practice. Thus, IS and organizational scholars have posited the notion of sociomateriality to address the significant neglect of technology in the interpretive information systems literature. Sociomateriality consequently emphasizes the ontological inseparability of objects from their context, which means that there is no social action that does not entail a material means. As Orlikowski and Scott argue [18] (p. 456): "Any distinction between humans and technologies is analytical only, and done with the recognition that these entities necessarily entail each other in practice". In other words, a sociomaterial ontology highlights the constitutive entanglement between the social and the material:

> The sociomaterial view asserts that materiality is integral to organizing, positing that the social and the material are constitutively entangled in everyday life. A position of constitutive entanglement does not privilege either humans or technology … Instead, the social and the material are inextricably related – there is no social that is not also material, and no material that is not also social [19] (p. 1437).

Thus, work researchers within the practice turn have a performative view of social and organizational phenomena such as knowledge, human activity and sociality: "Our world is increasingly in flux and interconnected, a world where social entities appear as the result of ongoing work and complex machinations" [20]. Technologies are constructed with particular material properties (hardware, software, techniques) and are inscribed with the developer's assumptions at a particular point in time. Thus, while Orlikowski et al. [21] underscore the role of images, descriptions, rhetoric and ideologies held by intermediaries such as translators, vendors, journalists, consultants, champions, trainers and managers, they provide no account of their materiality.

Thus, some dimensions of sociomaterial practice are foregrounded, especially the materiality of technology, while others, especially the affective and embodied dimension of social practices, are backgrounded or ignored. In this regards, the notion of sociomateriality can be questioned.

3 A Critical Evaluation of Sociomateriality

There has been a general lack of attention paid to discourse and affect in the study of the relationships between artifacts/objects and human activity among IS scholars. This is particularly the case with the sociomateriality movement, which holds that materiality does matter, but affect and identity much less so.

In the organizational field, recent sociomaterial discussions about the materiality of objects have not addressed the role of subjectivity in sociomaterial entanglement. The problem is succinctly expressed by Jones:

> These accounts, however, employ several different terms, sometimes interchangeably, to characterize the nature of this entanglement, such as inseparability, interpenetration, relationality, and embodiment, and to refer to what is entangled, for example the social and the material, humans and technology, work and technology. While such variation may be justified on aesthetic or stylistic grounds, treating these terms as synonyms may be seen as conflating different ontological claims [22] (p. 197).

In particular, the sociomateriality literature uses the "materiality" of the body and that of technology interchangeably, yet simultaneously neglects the affective and embodied dimensions of practices within existing formulations of sociomateriality. A good example of the specificity of the body is that bodies reject the word of symbolism by enduring pain, injury, illness, death, hunger, reproduction and ageing [23]. This is of particular importance in management studies where disembodied structures such as strategy, institutions or corporate governance have prevailed historically [7]. Furthermore, our sense of being a person, in other words our identity, is a symbolic construction which never precisely matches our physical body. As Burkitt [24] argues, there is always a gap between self-image and appearance. This is especially noticeable in pathologies such as anorexia, where the subject is convinced that he/she is fat, whereas everybody else perceives the opposite.

What is more, while bodies and embodied actions are arguably neglected in accounts of sociomateriality [25], the place of embodiment is nevertheless recognized more broadly among agential humanists. Thus, subjective notions of competence and identity can be understood as navigated corporeality. For instance, Suchman refers to embodied competencies, actions, practices, work, labours and knowing [26] – for example a nurse's dexterity in performing tasks [22]. In Schatzki, cognitive capacities, activities and understandings are all identified as being embodied [27]. Alternative body-sensitive approaches do exist, such as Reckwitz's definition of practice: "forms of bodily activities, forms of mental activities, 'things' and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge" [28] (p. 249). Furthermore, as Reckwitz says, "every practice contains a certain practice emotionality" such for examples the compassion or relational support of a nurse caring for patients [28] (p. 254).

Furthermore, objects generate and organize affectivity. Rheinberger sheds light on the power of material objects, arguing that objects are "open-ended" and operate as a source of interest and motivation by virtue of their "opacity, their surplus, their material transcendence", which is "what arouses interest in them and keeps them alive as targets of research" [29] (p. 406). This particular power of objects has been also analysed by Knorr Cetina [30, 31], who asserts that the source of this power stems from the subject's lack of completeness, which generates energy and emotional investment on the part of the developers. The attempt to "fill this void fuels the attachment for the object, but also paradoxically specifies ever further issues and the sense of lack, so that the process is self-fueling" [32] (p. 7).

However, object theorists tend to anthropomorphize properties of the object – it is not clear whether the "surplus" belongs to the objects or to their users' perceptions. Typically, object studies, influenced by actor-network theorists, have metaphorically let the objects talk, liberated and translated their speech and then provided them with the legitimacy which they had historically lost in modern times. Actor-network theory (ANT) is anthropomorphic in its attempt to provide objects not only with speech, but also with a "parliament of things" [9] (p. 142). In that sense, as an extension of Latour's metaphor, the sociologist would not merely be a puppeteer [33], but also a ventriloquist (this image is also used by Cooren [34]). Yet it is not clear what it is that speaks, i.e. what instance fundamentally mediates the technology's words and claims?

The materiality of the body and associated aspects of organizational practices, including affects, also lead us to address questions of power relations and domination. This is regarded by certain practice theorists as a promising research avenue [25, 35]. This issue raises the problem of the articulation of the material and the discursive. In addition, we should bear in mind that the body is not only the locus of agency and affective response, but also the target of power and normalization [20]. For example, Nicolini calls for further research exploring the relationship between siteness, knowing in practice and power:

> The idea that the site of knowing is always a specifically organized arrangement of practices reminds us that looking at knowing in practice necessarily requires addressing issues of interests, conflict, and power. This, in turn, necessitates being attentive to […] how deviance and resistance manifest themselves and are dealt with, and how normalcy is pursued through the attempt at making these differences disappear through material and discursive practices of hegemonic closure and "suturing" [36] (p. 616).

Specific knowing regimes are thus produced and performed in practice and through practice. However, the use of the word material in Nicolini's sentence is ambiguous, as it bears very different ontological presuppositions in Laclau's discursive theory of subjectivity (see [37]) and in object studies drawing on ANT.

In his overview of practice theories [20], Nicolini indeed distinguishes between two groups of authors in terms of the prominence they confer to discursivity – a distinction which reproduces the humanist/realist divide. On the one hand, authors belonging to the so-called contemporary Heideggerian and Wittgensteinian tradition, including Schatzki, Rose, Pickering [38] and Laclau and Mouffe, postulate that intelligibility presides over the functioning of practice; on the other hand, authors such as Giddens, Bourdieu, Barad or Latour are much more skeptical, for various reasons, as regards the potentiality of human intentionality.

In fact, Nicolini's scholarship does address affect, identity and subjectivity only in passing; he does not draw the ontological consequences of the link between the material and the discursive, and he relegates notions of collective representation or ideology to an old structuralist tradition, where the horizon of intelligibility was the causal "motor of conduct and the trigger of emotions" [20] (p. 173).

4 Ideology and Materiality

The study of ideology is too often conflated with idealism and determinism. What is missing in the literature is an account of ideology as materiality. I will illustrate this claim by discussing the interpretations offered of Braverman's study of ideology.

Ashcraft et al. [7] convincingly explore this complexity of materiality in a summary of the various forms of materiality in organizations, specifically in the context of communication, by introducing a distinction between discourse as material force or discourse exerted on material masses. Let us illustrate this with a classic study in IS. In *Labor and Monopoly Capital*, Braverman [39] argues that technologies deskill workers because, all else being equal, managers and staff choose designs and labour processes which divorce work from its execution. This is in fact the inevitable outcome of a dominant managerial ideology rooted in Babbage's principle of division of labour in the early nineteenth century and Taylor's scientific management. One symptomatic element is that the existing constructivist literature in IS [10, 40] tends to classify Marxist "deskilling" theorists, such as Braverman, as altogether deterministic and idealistic. According to Orlikowski and Barley:

> Unlike a strict materialist, he argued that American management's ideology of control determined which designs were commissioned and deployed […] Braverman told a decidedly deterministic story of NC tools' effects and his analysis, in retrospect, unwittingly hinged on the technical specifics of the type of NC tools used at the time he wrote [40] (p. 150).

Thus, based on the above, Braverman would tell a "deterministic story". This is perhaps unfair, given that the critical (and even revolutionary) ambition of Marxist theory has a very concrete transformative ambition. Orlikowski and Barley contest the primacy of ideology perhaps because they have a classic understanding of what ideology means. Deconstruction is in fact the necessary step which precedes construction: it is the necessary opening up of a new space of possibility, in which the new can emerge.

The second argument is that Braverman was not a "strict materialist". The trap of the exercise of Marxist critique is indeed to fall into conspiracy theory, which means overemphasizing the intentionality behind action, making connections without material evidence. Prolonging the Marxist discussion on the material reproduction of the conditions of production, Althusser [41] argues that this involves not only the reproduction of the means of production (the machines), but also the reproduction of labour-power (the people). The crucial point to us here is that reproduction is not automatic and always relies on "living labour" [42] (p. 263), which means the possibility for labour-power to refuse the injunction to work. From the former perspective, Braverman is clearly materialist by rendering contestation and an emancipatory project possible.

What is missing from Braverman and the classic definition of ideology is an account of ideology as materiality. In this paper, my objective is to explore, beyond sociomaterial interpretivism, a view which decouples technology from materiality. This proposed view is neither deterministic, as is the case with positivist studies, nor materialist in the sense that is usually ascribed to this word in the sociology of scientific knowledge. A view of ideology as materiality is crucial because non-materialist reading of Braverman tends to ignore the material dimension that his contestation of scientific management in practice can bear. Finally, this critical or deconstructionist view challenges various core

principles of interpretivism, namely the neutrality of the researcher and the principle of his/her non-intervention.

Thus far we have identified the underexplored materiality of discourse, affect and the body in existing sociomaterial studies. Affect is the notion which is absent in the existing theory of ideology at work to rematerialize ideology.

5 Rematerializing Ideology

A radical approach will now be elaborated, one which complements the traditional dichotomy between materiality and sociality by shedding light on the relationship between affect and ideology. From this perspective, ideology is not a corpus of text, but is embodied in our behaviour and rituals.

5.1 The Essex Lacanian School

This paper draws now on a corpus of authors who have thus far been insufficiently mobilized in organization theory, whereas these authors have a great potential for taking ideology seriously and studying how it affects sociomaterial work practices.

The Essex School of Discourse Analysis is a group of political theorists from Essex University, gathered around the figure of Laclau, who mobilize the post-Lacanian theory of ideology (including authors such as Butler) to study discursive phenomena in the political field. These authors, despite evolving in the Anglo-Saxon world, also draw heavily on French authors such as Althusser and Lacan. In what follows, I will demonstrate that much is to be gained by returning to the work of these theorists and by bringing ideology back into the study of technology in organizations. From this (Laclauian) perspective, social practices are primarily characterized by a state of "radical contingency" [43]; the reasons why people accept to engage in practice are never entirely sutured, and can always be challenged. Social processes are never entirely routinized, determined or mechanistic, but always depend on their subjective integration to function. Thus, the way we make sense of a practice is absolutely central to its functioning. The purpose of such an analysis is therefore to disclose this ontological contingency and to reveal how it is significant in shaping the actors' "ongoing affective identification with practices" [44] (p. 2) and the way their behaviours reproduce, contest or restore these practices. These subjective acts materialize the "trace of contingency within the structure" [45] (p. 435).

As we have seen, pluralistic approaches, known as practice theories, have highlighted the sociomaterial ontology and the inseparability of the material and the social. While practices are social and material, they are also affective and linguistic; thus, this affective identification with technology needs to be further explored. The subjective processes motivating the ritualization of everyday practice are under-theorized in IS. More importantly, this neglect is regrettable, as a focus on affect, subjectivity and signification would enable the rematerialization of the linguistic approach to organizations, thereby addressing issues including discourse, communication and ideology in a way which is more aligned with their subject-based roots. This ontological link between the

affective and discourse is for instance absent in Hardy and Thomas's account [46]; by contrast, the Essex Lacanian School is typically helpful in addressing the "affective turn" [47] in the study of materiality in organizations and information studies. This aspect is necessary for any radical approach to work studies, namely addressing the roots of IS and organizational phenomena, given the Latin etymology of the word (radix means root).

The following section seeks to discuss the materiality through which a subject copes with the determination of meaning, negotiates with it and keeps it at distance through discourse; this is the place of human agency, where contestation and re-signification are located.

5.2 Materiality of the Signifier

Based on the above, we can understand that the meaning ascribed to a practice has deep implications for the way in which people accept to identify and engage with it. However, what is the process through which meaning may affect our subjectivities and our identification with practice?

Identity, for Lacan, involves being desired by others and gaining recognition [48]. The "subject-in-meaning" [48] is constructed before the actual birth of the individual, for instance when a name is chosen. This recalls an important tenet of Lacanian theory, namely the importance of the name in the construction of identity. The name precedes the subject and provides it with a discursive place [49] (p. 55). The name is also the bearer of a string of meanings, and it is already invested with the desires of others. Let us consider a provincial name or an aristocratic name which bear different connotations. Identity can be read as a signifying practice: there are certain signifiers to which a subject becomes fixated. Certain signifiers matter more than others for the subject, and these signifiers contribute to the identity of the subject.

For Althusser, the determination of identity occurs through the interpellation of the subject by dominant discourses, metaphorically akin to a police officer embodying the Law, who interpellates a man in the street [41]. Althusser's argument of interpellation means that we are hailed, named and recognized through language, and our identity is constantly negotiated between subjectivity and interpellations. As a response to the structuralist stance in Althusser's work, Judith Butler in *Excitable Speech* argues that there is no reason why we should accept society's identification of us – the interpellation – as a particular sort of subject [50].

Thus, Butler imagines the following scene: the man in the street who is named, resists and protests about the name. Consequently, the interpellation misses its mark: "This is not me, you must be mistaken". The subject deals with the interpellation, negotiates with it, and identity is constituted by discourse, albeit at a certain distance from it. What is more, the interpellation might not have a speaker, yet it may take other insidious forms materialized through artifacts such as bureaucratic paperwork, adoption papers, employment application forms or gender categories [50]. The words by which we are hailed are rarely those we ourselves would choose; they may be traumatic or excitable, although there is always room for contestation and re-signification located in human agency.

From this perspective, there is always a primacy of the subject over the interpellation, a primacy of the signifier over the signified, in linguistic terms, which is captured by the notion of "the materiality of the signifier" [51–53].

The materiality of the signifier (a materiality that comprises both signs and their significatory efficacy) implies that there can be no reference to a pure materiality except via materiality. Hence, it is not that one cannot get outside of language in order to grasp materiality in and of itself; rather, every effort to refer to materiality takes place through a signifying process which, in its phenomenality, is always already material. In this sense, then, language and materiality are not opposed, for language both is and refers to what is material, and what is material never fully escapes from the process by which it is signified [51] (p. 37).

This fundamental autonomy of the signifier, the "sliding of the signified under the signifier" [53] (p. 71), is the condition for subjectivity to manifest its potential/power and its capacity of subversion, parody or displacement of meaning [51]. The switch from signified/signifier to signifier/signified is precisely where Lacanian theory departs from Saussurean semiotics, which has inspired studies in our field [54, 55]. Thus, the materiality of the signifier captures both signs and their "significatory efficacy" (Butler [50]), the signifier's retroactive affective effect on us, in a more central way than existing formulations of symbolic interactionism (e.g. [56]). This fundamental autonomy of the signifier is the condition for subjectivity to manifest its arbitrary power, its power to act [57] and its capacity of subversion, parody or rewriting [58].

This account is crucial, as it responds to the need to revitalize sociomaterial studies [7, 59, 60]. This does not mean negating the technicalities of technology, but rather that these are always already constituted within language. It means recognizing the status of technology not merely as a material artifact, but also as a material signifier which bears meaning in our life. The materiality of the signifier differs from the materiality of the referent (the object of discourse) and the materiality of the signified (its imaginary meaning). This is not tantamount to equating technology with discourse; instead, it implies that there is no reference to technical materiality which escapes the mediation of affective and discursive process.

In the following section, I will demonstrate how this corpus of authors offers a great potential to study work practice and technology in organizations. To do so, I will re-embrace the study of ideology in the workplace.

5.3 Reframing Ideology

To achieve the objective of this paper, namely to name and identify the play of affect and discourse, ideology needs to be rematerialized. This will lead me to introduce the notion of ideological fantasy to foreground the materiality of the affective register.

Ideology and Practice. One of Althusser's main contributions to Marxist theory is rematerializing the notion of ideology by radically rejecting Marx's assumption that ideology is a "false consciousness", a systematic illusion which has no history [41]. Thereby, he emphasizes the polysemy of materiality or matter:

> An ideology always exists in an apparatus, and its practices, or practices. This existence is material. Of course, the material existence of the ideology in an apparatus and its practices does not have the same modality as the material existence of a paving-stone or a rifle. But at the risk of being taken for a Neo-Aristotelician (NB Marx had a very high regard for Aristotle), I shall say that "matter is discussed in many senses", or rather that it exists in different modalities, all rooted in the last instance on "physical" matter [41] (p. 40).

The materialities of a displacement for going to a Mass or a stadium, of kneeling down, of singing a national anthem, of a prayer, of an act of contrition, of a gaze, of a handshake, of an external verbal discourse or in "internal" verbal discourse (consciousness), are not one and the same materiality. Consciousness itself becomes material and the notion of idea itself disappears from his framework (Althusser [41]). This is a crucial point: affect is not added to signification, but is "consubstantial with it" [61] (p. 326). The notions of subject, consciousness, belief and action remain. In addition, the new terms of "practices", "rituals" and "ideological apparatus" emerge.

Thus, Althusser's performative chain of determination of the subject can be read thus: the material ideological apparatus prescribes the material practices governed by a material ritual, practices which exist in the material actions of a subject acting in all consciousness according to his beliefs [41]. From this perspective, Althusser is more concerned with the "organization of thought", through ideological apparatus, rather than "thinking about organizations" by essentializing this notion [62]. Put another way, Althusser sees ideology as an organization of signifying practices whose function it is to turn individuals into subjects, and thereby provide them with a social and political identity. This standpoint adopted by Althusser fits Nayak's claim that process theory is not abstract but empirical; it doesn't exist but acts, it contributes to the process of provoking thinking to "think beyond" [5].

In this way, Laclau has elaborated an ontological definition of ideology, which is a condition for rematerializing ideology. Far from reducing ideology to "false consciousness", Laclau has inverted the old Marxist proposition. Thus, Laclau's theory maintains the Marxist concept of ideology and the category of misrecognition by inverting their content. Laclau's theory can therefore be described as post-Marxist because of its anti-essentialism:

> The ideological would not consist of the misrecognition of a positive essence [an illusion as to real class interests, for example], but exactly the opposite: it would consist of the non-recognition of the precarious character of any positivity, of the impossibility of any ultimate suture [63] (p. 92).

In other words, the invisibility of contingency is constitutive of the ideological misrecognition, and the critical intervention aims to render contingency visible. The critical intervention (the signifier) redefines and contests the dominant interpellation (the signified). The key idea here is that the deviation from Marxist theory of ideology is not only epistemological in nature, but also ontological: ideology is not an illusion, as in false consciousness, but pertains to the way any social reality itself is constituted.

Ideological Fantasy in Work Studies. To criticize an ideology, it is not enough to criticize a discourse or a text and to stay at the level of intentionality; we need to comprehend ideology not as a cognitive process, but rather as an affective cement or a

glue [64]. Burawoy is an organizational theorist who has conceptualized consent at work as being subordination to a ruling ideology. At the time of Burawoy, the site of the antagonism between labour and capital happened to be the factory floor:

> People do not carry ideologies around in their heads. They carry theories, knowledge, attitudes, in the form of consciousness. These become an ideology, "a material force once it has gripped the masses." Ideology is neither a "cold utopia" nor "learned theorizing" but a "creation of concrete phantasy which acts on the dispersed and shattered people to arouse and organize its collective will". Ideology acts as a cement for social relations; it binds individuals to one another; it connects immediate experiences to each other, to the past, and to the future [65] (p. 18, emphasis added).

Burawoy is here citing Althusser's work [66] (p. 168), which is seminal to the understanding of ideology as materiality. Burawoy is interested in why people accept having to work as hard as they do. In other words, he explores the concrete operation of ideology though which painful labour is made acceptable and ends up not being contested [65]. This occurs through the informal game of "making out" in the factory, which means making an acceptable percentage output, one not higher than 140% and not lower than 125%. When the chances of winning are too high, the game degenerates into "boredom", but when the uncertainty is too great, the game becomes "frustrating" [65] (p. 87). To function effectively and absorb the operators without diminishing returns, "making out" needs to keep the excitement intact, otherwise it falls into a crisis of "motivation" or "legitimation" [65] (p. 87).

This ideology which "acts as a cement", in other words this affective grip, is precisely what the Essex Lacanian School has explored in its most recent work by foregrounding the notion of "ideological fantasy". Burawoy, quoting Althusser, defines ideology as "a concrete phantasy which acts". In Glynos' words, it is not the description of ideology's content which matters, but rather its "capacity to account for an ideology's grip, its power to transfix subjects" [64] (p. 192), that is, the way ideology manages to exert its hold over us. Studies of workplace practices need to focus on ideological fantasies, as it is not enough to understand the discursive patterns if we wish to make sense of social practice: we must also analyse the degree of "libidinal investment" they arouse in the relevant actors [67]. There is indeed a research avenue addressing the power of fantasies to structure the motivations underpinning many economic and production practices [e.g. 68–71]. These studies, most frequently positioned within the field of critical management studies and inspired by the Essex Lacanian School, typically scrutinise workplace practices in terms of fantasmatic logic. Rather than describing the content of the fantasy, these studies look more specifically at the mode of attachment of social actors to their fantasy: the greater the attachment to and dependence on the fantasy, the stronger the ideological grip [72]. When a subject is overinvested in a fantasy, any attempt to destabilize the subject's fantasy narrative will be experienced as a threat and will generate anxiety [72].

6 Conclusion

In this paper I have questioned the notion of sociomateriality by shedding light on the ontological contingency which characterizes the social norms that sustain

practices. The ontological stance adopted here complements certain formulations of practice-based studies, for which notions such as contingency or re-signification are not immediately relevant, given that practice theory, as a genre, is the study of mundane activity, not specifically of its transformation. To address this issue, I have proposed a Lacanian approach, which considers ideology beyond linguistic idealism, and materiality beyond technological solutionism. I avoid any accusation of idealism by demonstrating that ideology is better understood by incorporating the affective dimension carried by discourse as a concrete signifying practice, which acts by interpellating subjects and by producing affective identification. Organizational and information studies can be better understood by acknowledging the materiality of the signifier, the way signification shapes behaviour and taken-for-granted practices. Furthermore, I have elaborated on the materialist theory of ideology as conceptualized by Althusser and applied to organizational theory by Burawoy. This notion is especially helpful for researchers seeking to provide critical explanations of how and why technology-in-practice is made vulnerable, obsolete and re-signified. Furthermore, the understanding of the materiality of the signifier and ideological fantasy are crucial in IS in order to autonomously frame issues such as consent at work, an issue which is becoming more important than ever in data-driven organizations.

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Inscribing Individuals into a Formalized System: The "Labour" Performed by Affective Spaces

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Abstract. A substantial amount of ongoing work in organizations can be characterized as processes of formalization in which unique circumstances are rendered legible to organizational frameworks and inscribed into institutionalized ways of knowing and doing. Embedded in these processes is the need to manage, distance, and condition the affective and physical experience of the players involved. Using twelve months of ethnographic data gathered in the Family Law unit of the courts in a large county of California, we explore *how* formalization happens. We find that a dynamic combination of *actants* (*technologies of formalization*) engender *affective spaces* that serve as *passage points* in the process of formalization. These affective spaces condition the bodies and emotions of customers in a manner that generally mitigates unstable intensity and renders the customer ready to focus on the "facts" of the case. We suggest that by attending to the multiple actants in an environment we are able to interrogate both the origin and effects of "affect" as well as better understand how key passage points work in the service of formalization processes. In so doing we expand the conversation about the challenges of public service delivery and put forth the beginning of a theory of how affective spaces serve organizational and institutional goals.

Keywords: Ethnography · Practice · Sociomateriality · Affect · Formalization · Process · Inscription

1 Introduction

Processes of formalization occur in numerous organizational and public contexts. Despite longstanding attention to the design and outcomes of formalization in organizations literature, little is known about the enacted and situated process through which formalization is made to happen on an ongoing basis. Beyond the creation of roles, rules, and procedures, maintaining relatively stable formalized processes requires ongoing and effortful attention to the translation and inscription of its inputs. Formalization[1] creates

[1] Formalization, as defined in Dictionary.com, involves "giv[ing] a definite form or shape [in order] to state or restate in symbolic form".

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distance between an account and its inscribed form; it serves as a point of transition from a complex state to a streamlined mold. Embedded in this process is the work involved in managing, distancing, and conditioning the emotional and physical experience of the players involved. Thus, this research asks how formalized systems are made to happen in ongoing organizational practice.

The courts provide a rich context in which to study the ways in which formalized processes are enacted and re-enacted in everyday work. In Family Law, court employees and litigants interact in periods of complex family crises – divorce proceedings, child custody arrangements, and domestic violence disputes.[2] Moving such activities towards resolution requires that a complex and messy personal issue be rendered into a form legible to the courts and amenable to formalization. Thus, it is an ideal environment to examine the multiple social, spatial, and material ways in which the individual experience is modified, tamed, and brought into line with codified organizational practices of translation and inscription in a particularly charged environment. In so doing we shed light on the layers of affective, emotional, and physiological experience that condition and are conditioned by dynamics of formalization.

Through data gathered from a twelve-month ethnographic project in the Family Law unit of the courts in a large county of California, we highlight the ways in which the spaces of service encounters engender a particularly potent affective environment that conditions the process of formalization. We propose that such *affective spaces* form key *passage points* through a process of rendering messy inputs amenable to formalization. Further, the *technologies of formalization* employed during these passage points condition the bodies and emotions of customers[3] in a manner that generally mitigates unstable intensity, easing a process of formalization and rendering a negatively charged environment into a seeming rationalized and controllable space.

2 Literature

Formalization processes have been a topic of considerable inquiry in organizations literature and play a central role in Weber's conceptualization of the bureaucratic organizational form. Formalization involves "the extent of written rules, procedures, and instructions" for the accomplishment of work tasks [1, 2]. Existing literature on formalization highlights its importance to the effectiveness of organizational work, ensuring role and task clarity [1], enabling coordination [2, 3], and providing a "common language" through the codification of tacit knowledge [4]. Given the positive outcomes related to effective formalization systems, current work has begun to postulate about how to design enabling formalization systems for employee fulfillment and organizational performance and flexibility under complex and uncertain conditions [1, 5]. In

[2] The majority of Family Law cases are self-represented. Under such circumstances, the need to create effective formalization processes becomes all the more pronounced, as parties lack familiarity and preparation with court proceedings. This creates challenges for all aspects of the formalization process.

[3] "Customer" is an emic term used by administrative employees of the courts for all people they serve and interact with – litigants, family members, etc.

examining the precursors and the effects of formalization systems, however, current scholarship has tended to overlook the ongoing, enacted and situated processes of rendering formalization systems viable once they are put in place in organizations.

As Vlaar et al. highlight, formalization is more than just an output (i.e. rules, procedures, contracts), but also "the process of codifying and enforcing outputs and behaviors" [6] (p. 439), [7]. A substantial amount of work in organizations can be characterized as ongoing processes of formalization achieved under unique circumstances involving inputs from external actors. In such cases, unique accounts of individuals are rendered legible to organizational frameworks and inscribed into stable, institutionalized formal procedures. The critical tasks of translating and inscribing individual accounts into a formalized system require ongoing work from organizational employees to manage, distance, and condition the emotional and physical experience of the actors so as to facilitate the process of formalization. However, scholars acknowledge that such behavioural aspects of formalization have been mostly overlooked [8, 9].

While Weber's [10] conception of the bureaucratic form highlights "formalistic impersonality" as a critical attribute that serves to eliminate or mitigate irrationality, emotionality, and friction [11], the role of affect in processes of formalization remains undertheorized [8]. A growing literature on emotional labour, "the silent work of evoking and suppressing feeling" [12] (p. 7), provides a starting point for this exploration, highlighting the invisible labour required of employees to provide "good service". In this research, however, we emphasize the affective elements of this process rather than focusing on the emotional labour required of organizational employees in order to account for the spatial and material elements that comprise the spaces in which this process is performed.

In so doing we build on the affective turn of the last few decades in the humanities and social sciences. Such scholars have taken the focus in the study of affect away from the realm of the cognitive and subjective to consider the realm of bodily capacities. Clough conceptualizes affect as "bodily capacities to affect and be affected", and suggests that such a conceptualization allows affect to be considered "in relation to the technologies that are allowing us both to 'see' affect and to produce affective bodily capacities" [13] (p. 2). This perspective opens the door for more holistic and comprehensive accounts of "affective labour" that go beyond the experience of one actor – traditionally the employee – in a complex system of labour. A focus on affect allows us to look beyond the "world of interiority of the human subject" [14] (p. 12) in order to focus on the ways in which the affective environment is designed, managed, and rendered productive.

Space is not a mere container for interpersonal exchanges; affective labour is conducted in active spaces. Reckwitz suggests that attention to the interplay between affect, artifacts, and spaces can be achieved through the study of practices enacted in "affective spaces", bringing attention to the idea that "affects are often directed at artefacts and objects and are structured by the spaces these artefacts and objects form" [15] (p. 254). Affective labour, therefore, involves the enrolment of the layout of a space, the physical artifacts within it, the social norms that colour and shape assumptions, and the highly charged psychological and physiological bodies who interact in an affective space.

In this paper we interrogate how people, objects, and elements of physical space come together in two key affective spaces of the Family Courts. We employ an actor-network theoretical (ANT) perspective [16, 17] in order to give equal consideration to the human and material actors, or *actants*, involved in this process. We find that ANT terminology provides a lens and a language with which to explore formalization as comprised of processes of *translation*, "the mechanism by which the social and the natural worlds progressively take form" [16] (p. 19) and *inscription*, "the result of translating one's interest into the material form" [18] (p. 143), [19]. We suggest that formalization is made up of points of transition, *obligatory passage points* that serve to move actors "smoothly between different specificities and their materialities" [20] (p. 205). Such passage points make court employees critical to the network and enable them to *enrol* customers and *technologies of formalization* to enact, legitimize, and stabilize the formalization process in support of organizational goals [16, 21].

We argue that by taking this perspective we are able to shed light on how the emotionally laden process of translating and inscribing personal family issues (e.g. divorce, domestic violence, child custody arrangements, etc.) into a formalized system works in practice. After reviewing our methods, we describe spaces that serve as key *passage points* in the formalizing process (i.e. the Self Help corridor and Clerks' office). We then present a suite of *technologies of formalization* such as physical layout, dress, information systems, and office supplies, and discuss how each works to prepare individuals and shepherd them through the practice of *inscription*. Finally, we examine how the threat of breakdown (or unwanted explosion of emotion) infuses ongoing practices and pervades the environment of each space. We conclude with a discussion of the role of *passage points* in maintaining and enabling formalized processes.

3 Data and Methods

This project is part of an ongoing ethnographic study in which we are investigating the work practices of the court in light of a new content management system's implementation. Thus far, we have collected twelve months of data from various departments within the Family Law unit of the court. Data include field notes from over 100 h of observations, interviews with 50 court employees, and observations during various executive and operational meetings. In this paper we use a subset of these data to examine the practices and interactions that occurred within the Self Help and Clerks' offices. Specifically, the first author's observations of the Self Help office and the Clerks' office conducted during court visits ranging four to eight hours in length once or twice a week over approximately 70 h were used. These observations were recorded in journals and then transcribed into copious field notes describing the layout of the spaces and interactions between employees and customers. In the course of observations, the first author engaged in numerous conversations with court employees. Such informal interviews were also recorded in daily field notes and transcribed as comprehensively as possible immediately after each visit. The first author took the stance of interested observer, combining at a distance observation and note taking with brief questions to court employees during breaks and transition times. The researcher dressed much like the

court employees and was relatively unobtrusive. We have no reason to believe that she was obvious to customers of the court and she did not interact directly with this population.

Data were analysed using an inductive approach to theory building, reviewing field notes, transcripts, codes, and themes. In the course of this analysis, the assumptions and key concepts of actor-network theory resonated with us in two key ways: ANT provided a flat ontology with which to give equal consideration to people, objects, and spaces and provided a rich language with which to describe these actants and theoretical frames such as "translation", "inscription", and "passage points" that provided theoretical inroads towards making sense of these data.

Using a grounded theory approach [22, 23] we first noticed the importance of the Self Help and Clerks' offices in getting people "through" the system and making progress on resolving whatever issue brought them into court. Thus, we first coded these data with an eye towards the individual experience of moving through the process of resolving an issue. In theorizing how the individual was affected by the material, physical, and social environment of these particular spaces we then conducted a second round of theoretical coding examining how bodies, objects, and elements of the physical space played into this process. These insights helped us see the Self Help and Clerks' offices as affective spaces that acted as key passage points through a highly codified bureaucratic system. Throughout the process of coding, the first author wrote theoretical memos that were shared and debated between authors.

4 Findings

The Self Help and Clerks' offices are tasked with dealing with difficult situations and getting to moments of temporary resolution, whether it be the next step in case processing or managing an emotional outburst. These steps delineate and propel movement through a process of transforming complex situations into inputs amenable to the existing formalized system. These offices provide multiple forms of "passage": legal transition from no file to an official case file; physical movement of information from the outside to the inside of the court's offices; symbolic movement from a private matter to public matter and from problem to resolution. They provide a passage from the uniquely personal and emotional experiences of customers into streamlined and rationalized legal accounts of a case. In order to gain traction on how these passages happen, we examine the spaces in which these transitions take place. After providing an empirical description of two key passage points, we examine how organizational and institutional goals are accomplished in these affective spaces through various *technologies of formalization*.

4.1 Empirical Description of Passage Points

Self Help. The Self Help office is located on the first floor of the court building. The line outside of Self Help often extends along the perimeter of the first floor, making its way around the boxed hallway that surrounds an open staircase at the centre of the room. Customers queue up in the lobby of the court before entering the Self Help corridor

(which sits outside the main Self Help office). Bright, fluorescent light permeates the hallway into the Self Help corridor.

At any point in time, the line for Self Help services usually has ten to fifty customers. On average, customers wait between twenty minutes to an hour before they make it to the threshold of the Self Help corridor. There are no chairs in the first floor hallway, but a wide ledge surrounds the centre staircase and customers who are waiting for help or filling out paperwork sit on it. Customers waiting to gain entry into the Self Help corridor must stand in order to secure their spot in the line.

Only a handful of customers are allowed to enter the corridor that precedes the service windows. Once a customer makes it inside the corridor, they are able to see the service windows. Upon reaching the entryway, customers typically wait an additional ten to twenty minutes to be called to a window.

Four service windows help customers. A clear sheet of plastic separates the employee from the customer at each window. A slate at the bottom of the plastic sheet is intended to allow customers and employees to move paper from one side to the other. A circular opening strategically placed at the centre of the plastic sheet is meant to allow conversation between customer and employee. The four windows are partially enclosed, and employees and customers can hear each other's conversations. The windows are housed in a tight rectangular office space. There is just enough room for the employees' workstations that accommodate their office supplies and computers, where they log customer tickets in an online tracking system or use the case management system to look up case information.

The workstations set up at the first three windows are standing stations. Employees either stand or sit at tall bar stools as they help customers. The fourth window is for disabled patrons, so the employee is seated behind the desk in a regular chair. The design is intended to mimic the height at which customers will be standing or sitting when they come to the windows and to allow customers and employees to engage at eye level. Two printers are placed between workstations. At the far end of the windows, a door leads to the Sheriff's break room.

The space in the corridor is cramped and people are constantly moving in and out. Only the customer requesting help may approach the window. The constant flow of people, the bright lighting, the hum of conversations between employees and customers, and the constant buzz of printers creates a loud environment.

After obtaining information at a service window, customers are asked to complete necessary paperwork and return for a document review consultation. Many customers complete their paperwork inside the court building and return for document review on the same day. Customers who request document review wait in the first floor lobby of the court building (the same area where the line for help at the windows is formed) and are called into the main office by one of the paralegals.

A large room next to the Self Help windows houses employee cubicles where paralegals provide document review consultations. A large centre table provides a makeshift consultation area. Often document review takes place at the centre table, and paralegals go back and forth to their desks to look up information on their computer. Self Help employees typically end customer interactions by directing them to the seventh floor

where the Clerks' office is located and handing them a yellow post-it note with the office's location in order to file the paperwork that has just been completed.

Clerks' Office. The Clerks' office houses public filing windows where customers submit paperwork and obtain appointments for court hearings. The line to enter the Clerks' office windows extends into the hallway and wait time ranges from ten minutes to an hour. There is a check-in window on the right hand side of the room and eight filing windows line the left side.

The check-in window is enclosed with clear plastic like a fish bowl. Once customers check in to the Clerks' office, they obtain a number that will be used to call them when a clerk is ready to process their request. A waiting area is located across from the filing windows. Guests may accompany customers to the waiting area but cannot approach the windows. Once inside the waiting area, customers typically wait an additional ten minutes to an hour and a half to be called.

Waiting customers face the filing windows like an audience at a theatre; chairs are set up in four rows of twelve seats each. The seating area is dimly lit; occasionally customers bring their own books or magazines to squint over and pass the time. Often people are playing with their smart phones. A sign at the entrance asks people to silence their phones while in the office. The room is relatively quiet, although it can get loud depending on the time of day and the number of people who are waiting; a few people nod off as they wait for their turn. To the far right of the filing windows is a separate area that houses kiosks for electronic file review. Customers sit at computer workstations where they can review information from their case file.

The filing windows are set up in a similar fashion to the Self Help windows, but the space is larger and customers have more privacy when addressing the filing clerk. Since there is more room between each window, it is hard to hear other conversations, but not impossible. Each window has a pane of clear plastic in front of it that separates the employee from the customer with slots that allow employees and customers to hear one another and to pass information from one side to the other. An opaque sliding partition allows employees to close off their space from customers' view. Clerks may ask customers to take a seat while they process their request and then proceed to close the sliding partition until they are ready to call the customer back to complete the service transaction.

The main office space for case processing is located behind the filing windows. Cubicles line the back side of the room and employees who are not interacting with customers sit at their cubicles and process paperwork into the case management system. The office space is lined with shelves that contain paperwork yet to be processed as well as forms that must be sent to Records for digital scanning. The constant buzz of printers and continual stamping of paperwork is difficult to ignore.

4.2 Technologies of Formalization

By framing the Self Help and Clerk's offices as affective spaces that serve as *passage points* we are able to gain traction on how the practices of translation and inscription into legible court case files is performed and how these practices serve to animate the

system of formalization in the courts. These technology-mediated work practices involve the coming together of physical spaces and workplace norms in service of organizational and institutional goals. We refer to this dynamic combination of actants as *technologies of formalization*, as they serve to engender *affective spaces* and to manage an inherently unstable environment. Examples of *technologies of formalization* include ***space*** (the physical and sensory space in which these interactions take place), ***style*** (as evinced by material elements such as dress as well as communication practices and organizational norms), and ***objects*** (the artifacts that participate in the service transaction). Next, we explore the ways in which these various technologies constitute and serve the ongoing processes of formalization. We highlight how they serve, occasionally undermine, and render possible the processes of translation and inscription that underlie formalization.

Space. We find that the physical and sensory spaces in which customers obtain help and file their paperwork configure the body in specific ways. Customers wait in line for lengthy periods without chairs or entertainment to minimize or distract from their bodily discomfort. The lighting is either too bright or too dim. Noise abounds. Customers are expected to endure this embodied experience without complaint and, in so doing, we assert they become physically disciplined into an emotional and physical state that eases the process of inscribing their experiences into the formalized system.

In addition to the physical/sensory spaces of waiting, the material experience of interacting with a court employee serves to manipulate the customer in ways that enable formalization. The plastic panes and partitions that enclose the windows serve to create distance between employees and customers by forcing bodies to strain and bend in order to effectively communicate. Partitions both stifle and carry sound and hinder visibility. Court employees are aware that interactions with customers are strained based on the embodied difficulties. During a tour of the Self Help office, David,[4] the supervisor, acknowledged the limitations of the space.

> Whoever designed these offices didn't know what they were doing. See the partitions? Sure, they are there to protect the employees but they make it hard to hear. The room gets so loud. And the fact that they are partial makes it so that the conversations blur together. I am one of the loudest employees in the unit, and when I am helping someone, it is hard for the others to hear. And, look at the openings for the customers to talk to the employees. They are too high for most of our customers. So they end up bending over and using the slots for paper to communicate. They press their ears against the plastic in order to hear better. And the space is so cramped.

A close examination of these spaces reveals that the embodied experience they engender mirrors the nature of the tasks performed within them. The formalization process requires an active effort to delineate the boundary between private crisis and public record. Court employees are expected to translate customers' stories and mold the narrative of the case into "rational facts" that are intelligible to the case file template. Similarly, the physical spaces of service interactions create barriers that separate customers from court employees, break up their experience into different lines and

[4] Pseudonyms were used in place of the names of court employees in order to preserve anonymity.

rooms, and generate bodily discomfort that forces customers to contort and to mould themselves for the encounter. We argue that the affective and embodied experience of becoming ready to fill out and submit the necessary forms matters. This experience serves to prime the customer to accept a modularized and condensed version of a highly personal and often emotional narrative. The uncomfortable and overloaded body is a body prepared to give binary answers to difficult questions and strip details from a story that are not necessary to the formalized system.

Style. In addition to spatiality, a focus on affective spaces draws attention to the socio normative environment where interactions take place. The style, demeanour, and approach of court employees are critical to creating a passage point from private to public. Court employees dress in professional attire, a stark contrast to the casual garb of customers. The employees' speech and demeanour also highlight their institutional knowledge – in contrast to the lack of knowledge carried by the many self-represented litigants in Family Court who are interacting with the courts for the first time. The customers' transition into an institutional realm is punctuated by these forms of disparity that bring into relief the customers' need to find guidance in these passage points.

Further, the assumed formality in the speech and dress of the employees creates a barrier between them and those they are serving. This barrier legitimates a particular form of interaction – kind, but businesslike. The employees' otherness can serve to jolt a customer out of the emotionally laden complexity of a situation and narrow in on the need to know the facts. When discussing his approach to engaging customers at the Self Help window, David highlights the importance of narrowing in on the facts with pointed questions. "After greeting them", David notes, "I immediately ask for their zip code and turn to my screen to type it in. I need the zip code anyway for my stats and this forces them to snap into the moment and to focus on giving me the information that I need in order to help them".

By asking a simple question David creates a neutral starting point with which to engage customers and move them through this key passage point. Like David, Sam, a lead clerk at the Clerks' office, engages customers in a friendly manner but opens with a question that highlights her position in the exchange as the professional who needs information in order to lend her expertise to the situation:

> I am always friendly and professional with the customers. But I get a feel for what they are trying to share with me. Are they giving me information that I need? If they are venting, I feel for them, but I have to focus the conversation. I'll politely stop them and tell them that I need to focus on processing their paperwork in order to get it right. Sometimes, I'll tell them to take a seat while I process their paperwork and that I will call them back to the window when I am done. I then turn to my computer and start typing or searching the system. If it is loud or if they keep approaching me to talk, I politely close the window so that I can focus on what I am doing. When I call them back, I explain everything I've done in detail and what they have to do next.

Sam's ability to distance herself from the potentially emotionally charged nature of the exchange serves multiple functions. Her continual work to bring the focus of the interaction back to its practical and "productive" elements (e.g. case filing, calendaring of hearings, etc.), while remaining professional and courteous serves to both guide and control the customer. Sam's formal dress, polite demeanour and professional persona work in strange alignment with the embodied experience of waiting prior to reaching

her. Sam guides the storytelling while implicitly managing the possibility for emotional spillover by the customer. This process is made easier because the customer has been rendered ready through the waiting process.

While not every customer will respond to the affective environment in the same manner, we witnessed the effects of these affective spaces on drawn faces, docile bodies, and a willingness to answer questions about complex scenarios with short and truncated responses. Thus, we argue that the sensory, physical, and socio normative aspects of these affective spaces work together to guide the customer forward in the processes of translation and inscription that constitute formalization.

Objects. In addition to managing the affective spaces in which service takes place, a variety of tools and objects perform the work of inscribing case files throughout the service encounter. These tools include the computers and embedded case management system in which records are ultimately codified, the paper forms in which information is captured and streamlined, and the office supplies that are used to direct, highlight, erase, and organize customer information into the form that is required for processing.

David, for example, literally wears his tools around his waist. An actual belt contains a stapler and staple remover, highlighters, ballpoint pens, whiteout pens, and post-it notes. The office supplies in his tool belt serve to manage the interaction and direct the flow of information through the passage point. Similarly, the following encounter between Sylvia, a paralegal in the Self Help office, and Mary, a customer involved in a document review consultation, exemplifies the use of office supplies to direct attention to and guide the process of translation and inscription.

Sylvia: Hi, can I take a look at your packet?
Mary: Yes, here it is. I wasn't sure how to fill out some of the sections…
Sylvia: OK, let me take a look
Sylvia: Are you requesting spousal support?
Mary: I just want money for my kids. I don't need anything else from him but to be responsible…

> As she is talking, Sylvia takes another pen from the bin at the centre of the table and hands it to Mary. Mary grabs it and looks at the paper. She stops talking in order to review the portion of the form that Sylvia is pointing out. Once Mary pauses, Sylvia asks her another question.

Sylvia: Do you want to be able to seek spousal support at a later time?
Mary: I don't know. What should I do?
Sylvia: I can't give you legal advice. You need to fill out this section if you want to be able to seek spousal support at some point or fill out this other box if you do not

> Sylvia points to the two check boxes. She has highlighted this section to make it easy for Mary to see. Mary reads the two prompts next to the check boxes and hesitantly marks the box requesting spousal support. Sylvia takes the paper again and continues reviewing Mary's entries.

In this exchange, Sylvia strives to complete the document review session, attend to Mary's questions while eliciting information required to complete the form, and guide

Mary in completing the form accurately without giving her legal advice.[5] Familiar office tools enable Sylvia to guide Mary through document review and focus on the information required by the system. By simply highlighting the section of the form that requires attention, Sylvia's actions lead Mary to suspend her emotional response to her husband's act of abandonment and to simplify the decision to the selection of a check box.

In some cases, however, tools undermine the practices of codification and inscription necessary for the formalization process. The electronic case management system, for example, contains a record of every interaction between the customer and the legal system so as to facilitate case processing within the court. However, a computer screen that displays all case records, when visible by the customer, threatens to expose the complex links between multiple elements and, in so doing, complicate the practice of inscription (in which information needs to be presented as linear and distinct). As Sylvia describes:

> The main reason that I use the centre table for consultations is that I don't want customers looking over my shoulder at the computer screen. If they are here for document review, I want us to focus on the document that they are getting ready to submit. If we sit at my desk and they look at their case online, they start asking questions about other documents and the status of the case and the consultation gets out of control. This way, every time we need to consult something in the system, I have to stop and walk over to my desk. It forces them to think through what they want to ask and what they tell me about their case.

Table 1. Technologies of Formalization

Technologies of Formalization	Examples	Role (inform, constitute, and shape the process of formalization)
Space	Physical layout (rooms, service windows, consultation table, etc.) Lines Plastic partitions Sensory elements (lighting, noise, etc.)	Materialize and constitute the formalization process through modularization and delineation Draw attention to the physical and material through bodily discomfort
Style	Dress Communication practices Organizational norms	By rendering something formal right away, create a barrier or distance from the emotional
Objects	Computer screen Case management system Case forms Office supplies (highlighter, whiteout pen, stapler, filing stamp, etc.)	Focus attention on the practical elements of the case Help to streamline and simplify the complex narrative of a case

[5] Court employees must limit their interactions to the provision of legal information. Providing legal advice without being the attorney of record on a case is punishable with a fine. Family Law Facilitator Act, Family Code Sections10000–10015.

Table 1 summarizes the various technologies of formalization, highlighting their functions and various roles they play in the process. They inform, constitute, and shape the process of formalization by enabling practices that limit, control, and bottle the potential intensity of the emotional exchange. As such we find these key passage points serve as affective spaces that anesthetize potentially negatively charged environments into seemingly regularized and controlled environments oriented around the practical elements of case processing.

4.3 Preparing for Breakdowns

Various forms of breakdown threaten the environment and stability of these affective spaces, thereby compromising their viability as anesthetizing and effective passage points. Breakdowns can occur at various levels of the organizational chain; examples include *communication and material failures during the service encounter* (e.g. emotional outbursts, lost or missing paperwork, etc.) and *organizational process changes or disruptions* (e.g. the implementation of new technological systems, backlogs, etc.). Next, we examine examples of breakdowns and the ongoing efforts involved in anticipation and reaction.

Communication failures. A customer who arrives at the courtroom in an angry and anxious state may find him or herself increasingly frustrated about the wait as he/she makes their way through a line. Such an accumulation of anger, anxiety, and frustration may not always dissipate over the course of accommodating the body to the embodied experience of waiting and travelling through lines and inuring the senses to this particular environment. In fact, such an environment might foment an angry outburst when a customer is confronted with an upsetting fact or confusing instruction. In these moments, court employees are confronted with an unruly situation. David, the Self Help supervisor, explains the ways in which he and his staff respond to emotional outbursts at the service window.

> When someone comes in here and starts yelling and making a scene, we do the best we can to calm them down, help them, and get them going. Then, it is all hands on deck. We all go to the other side of the windows with clipboards and pens in hand. We try to serve the customers who were in the office at the time of the outburst quickly and get them going. We smile and get them help quickly. We wait to bring other people in. We clear the air. We need to clear the air. We can't have these kinds of outbursts affecting the mood of the room. People come in here with problems and if the air is tense, they feel it and it affects them. It is all hands on deck and we clear the room as quickly as possible. Once we've cleared the room, we can go back to normal. We get behind the windows and then bring in a new batch. But, we've cleared the air and manage to get the negative energy out.

When negative emotions surface and disrupt the order that is negotiated by the formalization process, employees find ways to break the distance between themselves and customers and to increase the pace of service delivery. As David's approach suggests, technologies of formalization are temporarily set aside. Court employees remove themselves from the plastic enclosures that create a physical distance from customers; they move away from the computer screens that take their gaze away from customers; they increase smiles to break the demeanour of professional experts. New

tools are enlisted to regain stability. In these cases, clipboards serve a special purpose. They call into being temporary surfaces that facilitate inscription while allowing employees to stand next to their customers. This enrolment of new tools and strategies suggests that employees actively foster the emergence of a new, if temporary, affective environment – one through which the "negative energy" is cleared out.

Process Changes and Disruptions. Breakdowns also occur within the organization. Changes in organizational process have a direct effect on the affective spaces of work. For example, the recent introduction of a new case management system caused a great deal of anxiety and frustration among employees. Managers launched an internal campaign to ease tension; their slogan was "Keep Calm and Odyssey On". Signs were posted throughout the building for customers to see and read, "Please be Patient. Information Loading". In addition, during the first week of implementation, back office employees were asked to work the lines of waiting customers, carrying clipboards and checking on customers. Throughout this week, employees were asked/allowed to wear casual clothing. Tina, the manager of the Family Law Unit, explains that the reasons behind this procedural change were twofold:

> During [system] go live, we had employees here wearing T-shirts and jeans. It was casual day every day. We knew they were hurting and we wanted them to be comfortable. We also wanted to let customers know that something was going on, that we were going through something; we were not at our best. So, we dressed casually. We were one of them [the customer] for the week. We were walking around and talking to them, calming them down and sharing in their frustration. It humanized us. They saw we were human; we were one of them, and we were trying our best.

Such change challenges the institutional authority and expert status of court employees. The same style and demeanour of court employees that once facilitated passage into a particular institutional sphere now create dissonance, as they lose status as a marker of expertise. In order to manage this tension between a formal, structured environment and a new, unstable, and evolving practice, managers actively dismantle technologies of formalization into more intimate and human elements. Such an approach to the crisis has the potential to create a different kind of bond between employees and customers, one that will engage both of them in a relationship of co-creation of the case through mutual questioning and learning.

Table 2 summarizes the forms of breakdown that emerged in our data collection. We witnessed a transformation of the sociomaterial and affective space that emerges in response to breakdown. However, there are costs involved in such a transformation. It involves fundamental changes to the practices, pacing, and embodied experience of work. Away from their computer and armed with only paper and clipboards, employees must find time to complete the work of creating and modifying electronic case files after a service encounter rather than alongside it. Furthermore, fostering a qualitatively different affective environment through more intimate customer encounters and a heightened awareness of negative emotions (in both customers and employees) involves new tactics and practices that may increase emotional strain. Understanding the preparations involved in dealing with the threat of breakdowns in key passage points highlights the ways in which technologies of formalization are effortful elements of a process that is generally experienced as, stable, effective, and normalized to those within it.

Table 2. Breakdowns

Types of breakdown	Examples	Threat to formalization process	New objects/ practices that emerge	Role & implications
Communication Failures	Emotional outbursts	Threaten the negotiated environment	Clipboards	Role served:
	Lost/missing paperwork	Heighten the negative affective state of the court's customers	Signage & slogans along office walls	Remove physical distance
	Errors/ inaccuracies in the case management systems		Physical mirroring	Transition from muted exchange of facts to intimate co-creation of case
Organizational Process Changes & Disruptions	New system implementation	Undermine the professional otherness and expertise of court employees	Collapsed space of employee–customer interaction	Implications:
	Backlog		Casual dress	Change the pacing and timing of work
	Internet service interruptions			Change the affective environment of the spaces and interactions
	Personnel changes			Transform/ increase affective labour that goes into managing inscription.

5 Discussion

In the courts, the Self Help and Clerks' offices provide points of transition from private family crisis to public record, from messy stories to formalized inputs. Our analysis provides a deeper understanding into *how* these messy and unstable practices of translation and inscription happen. The two key passage points involved in this process are critical to the successful enrolment of customers into the system. They embody the transition from discomfort to relief, mimicking the transition from problem to resolution that customers seek.

As Callon articulates, "the notion of translation emphasizes the continuity of displacements and transformations which occur in [a] story" [16] (p. 18). In this process,

displacements occur along and within each passage; displacements of negative emotion and personal crisis into physical discomfort are followed by displacements of physical relief into an affective environment that renders the inscription of customer accounts into the system possible. Customers must wait in long lines, stand for extended periods, and endure affective discomfort before they make their way into these offices. Upon reaching their destination, they find moments of relief and attention to their needs. In these moments, translation and transformation into the formal system are possible with the active enrolment of technologies of formalization that displace individual interests into mutual accommodation in service of the formalization process. Technologies of formalization enable displacements of physical relief and emotional exhaustion into affective neutrality, enabling the process of translation and inscription into the legal system.

The passages that are afforded within these spaces may not be pleasant but they are productive in so far as they enable movement along the system [20]. Without bowing to questions of organizational design or human intentionality, we argue that the affective flows called into being through the various technologies of formalization in these key passage points serve organizational and institutional goals. In sum, these spaces condition the bodies and emotions of customers in a manner that generally mitigates unstable intensity and renders the customer ready to focus on the "facts" of the case, as delineated by the legal system.

This effect appears to be in line with theories of bureaucratic structure and its ability to elicit affective neutrality [10, 24]. However, the lens of affective spaces suggests that achieving an agentic engagement with an organization does not emerge in a vacuum. Rather, the anesthetizing quality of the bureaucratic interaction is a product of the affective spaces that bring into possibility certain processes of formalization. Such spaces serve to stabilize the formalization process in support of individual, organizational, and institutional goals. It is in the interest of individual customers to successfully translate and inscribe his/her unique situation into the formalized system in order to realize a desired goal (e.g. divorce, custody arrangement, restraining order, etc.). It is in the interest of the organization that the formalized system "works" such that influx of inputs are made codifiable and actionable and effective outcomes are achieved. And it is in the interest of the institution that legal service appears stable, consistent, and legitimate. Thus, we argue that affective spaces are a critical aspect of both specific formalizing practices and the maintenance of bureaucracies more generally.

On a different note, a move towards virtualizing service encounters through information systems poses new challenges. In establishing how affective flows in key spaces foster formalization processes, this work calls into question the assumption that customers would be better "served" by a virtual process that removes physical discomfort and interpersonal interaction when establishing cases in Family Law. Having outlined the importance of space, people, and materials in the enactment of effective inscription, the removal of these very elements requires a new way of thinking about how organizational and institutional goals may be achieved through new media and in the absence of spatial and affective management.

6 Conclusion

In this paper we examine the ways in which physical space, objects, and flows of affect serve the organizational and institutional goals of translation, inscription, and formalization. Making the personal public and legible to a formal institution is a precarious endeavour. We argue that translating volatile personal issues into an institutionalized system and moving a case and its parties to a legally recognized "resolution" is an ongoing and effortful accomplishment brought into being by numerous actants. By embracing how bodily experience and emotions are conditioned in this sociomaterial space, we are able to shed light on how this process of formalization is made to happen. In so doing, we look beyond human intentionality to explore the multidimensional forms of "labour" that go into taming the individual experience and act in service of organizational and institutional goals.

In sum, this paper proposes an ontological shift in understanding "affective labour" and the affective practice of translation, inscription, and formalization. We suggest that by attending to the multiple actants in an environment that, consciously or otherwise, produces and reproduces "effective" affective spaces, we are able to interrogate both the origin and effects of "affect" as well as better understand how key passage points work in the service of formalization processes. In so doing we expand the conversation about the challenges of public service delivery and put forth the beginning of a theory of how affective spaces serve organizational and institutional goals.

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When Is an Affordance? Outlining Four Stances

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Abstract. *Affordance* has emerged as a core concept in information systems (IS) research during the last decade. This relational concept is applied to understand and theorize the relationship between the social and the technical. In the works of the concept originator James Gibson, the relation was mainly portrayed as an ever-existing fact between the natural environment and an animal. In contrast, IS research focuses on relationships in-the-making between artificial things and human beings. In the IS context, we have identified vagueness in temporal and relational ontology: *when* do affordances exist and between whom or what? In this paper, we delve into the temporal and relational questions that have been omitted in much of the IS literature. What kind of a relationship is an affordance and when does it occur? Based on our hermeneutic understanding, we identify four stances from the existing literature. We classify those stances as *canonical affordance*, *designed affordance*, *potential affordance*, and *affordance as completed action*. We further argue that each stance has its own assumptions, consequences, and thus strengths and weaknesses.

Keywords: Affordances · Ontology · Relational · Temporal · Information systems

1 Introduction

> The central question for the theory of affordances is not whether they exist but whether information is available in ambient light for perceiving them (Gibson [1], p. 140).

Affordance is a highly influential yet controversial concept [2]. It originates from the writings of James J. Gibson and has been a source for inspiration in many fields of research [3]. It has also found its way into our field of information systems (IS) [4, 5]. As a *relational* concept, it has provided a promise of a middle ground between technological determinism and voluntarism/constructionism [6]. For example, Majchrzak, Markus, and Wareham [7] recently positioned affordance theory as "a lens that is particularly well suited to help IS scholars build theory about ICT use" (p. 272).

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The trouble of affordances as "relational" is that a "relation" has many different meanings [8, 9]. For example, is affordance a relation between the natural environment and animal, artifact and designers, designers and users, artifact and artifact, artifact and users, or among everything in a particular context? And how does that relationship emerge, when does it expire, or is it always present?

Proponents of the "relational turn" in many disciplines [10, 11] would argue that everything is relational. In an everyday sense, talking about anything requires a relationship to what we are talking about. We must be able to see it, feel it, hear about it, or at least think about it – not to mention that *talking about* is already one kind of a relationship between the talker and the talked about. For Gibson, that relationship was perceptual [12], although his notion of perception went far beyond visually seeing things [13]. In fact, Gibson "never explicated fully what he meant by perceiving things with reference to an animal" [14] (p. 112).

For the advancement of affordance theory in general and for IS research in particular, it is crucial to address *what* kind of a relationship is an affordance and *when* does it occur? These are the questions we address in this paper. An affordance's existence – its ontology, including its relational and temporal definition – is of the highest importance for further application and advancement of this concept. We researchers should share an understanding about the conditions under which this seemingly familiar concept we so often talk about does or does not exist.

In this paper, we outline four different stances from the research literature. All of these stances are consistent with Gibson, at least as much as Gibson is consistent with himself. Yet, each stance differs in its emphasis. We do not claim that any of these stances is better than the other, nor do we intend to create the proper ontological status for affordances. Instead, we aim to record the circulation of different ontologies in the IS community and build an argument for the situations in which each has its strength. The four stances are: canonical affordance, designed affordance, potential affordance, and affordance as completed action. Before going into those stances, we offer a short overview to how ontological aspects of the affordance theory were treated by James Gibson and his followers.

2 James J. Gibson: Affordances for Good or Ill

> The *affordances* of the environment are what it *offers* the animal, what it *provides* or *furnishes*, either for good or ill. The verb *to afford* is found in the dictionary, but the noun *affordance* is not. I have made it up. I mean by it something that refers to both the environment and the animal in a way that no existing term does. It implies the complementarity of the animal and the environment (Gibson [1], p. 127, emphasis in original).

The concept 'affordance' originates in the work of ecological psychologist James J. Gibson. The concept has been highly influential [15] while also remarkably controversial [2, 16]. The word "affordance" was first mentioned in Gibson's 1966 book *The Senses Considered as Perceptual Systems* [17], yet it is most popularly known from his 1979 book *The Ecological Approach to Visual Perception* [1]. Some differences exist between the earlier and later formulations. Jones [14] has observed how early Gibson claimed

"when an object's properties are perceived, one can detect the affordances of that object", while later Gibson insisted that "perceiving an object's properties and its affordances are quite different" [14] (p. 112).

A look into Gibson's above definition reveals how it is purposely vague [14]. The definition starts with "affordances of the environment" – hinting that affordances are, indeed, solely *of* the environment. The later part of the definition emphasizes complementarity. Gibson [1] elaborated that an affordance is "neither an objective property nor a subjective property; or it is both if you like. An affordance cuts across the dichotomy of subjective-objective and helps us to understand its inadequacy. … An affordance points both ways, to the environment and to the observer" (p. 129).

This is the level of specificity that Gibson provides. He points to interesting directions but leaves open where affordances come from and how long they persist. For Gibson, affordances simply exist. That's it. In fact, Gibson tackled further ontological inquiries by claiming that whether affordances exist or not is "not a central question" [1] (p. 140). This dodging of ontology has attracted many critics. In particular, Costall [18] has called the omission of existence as "self-defeating": "How could something that did not exist be 'directly perceived'?!" (p. 48). Costall [19] has also attacked that "by foregrounding the issue of perception Gibson put the epistemological cart before the ontological horse" (p. 89).

In this paper, we dive into the *existence* of affordances. We are not the first in this task [20–23], but our niche is in articulating a contribution to IS research specifically. We argue that an affordance's ontology – particularly its relational and temporal definition – is of the highest importance for the advancement of affordance theory. The difference between this paper and most previous approaches is that we argue against a single affordance theory. Instead, we promote multiple stances.

In the next section, we outline four stances from the literature. All of these stances are consistent with Gibson but they differ in their emphasis. We do not claim that any of these stances is better than the other. The stances are: canonical affordance, designed affordance, potential affordance, and affordance as completed action.

3 Four Stances for Affordances

In this section, we formulate four stances to clarify the various relational and temporal aspects scholars are attributing to the affordance concept. Table 1 summarizes the hermeneutic understanding developed through retrospective and prospective analysis of the literature of affordances. The table briefly describes the four stances, their relational and temporal ontologies, assumptions, and corresponding examples. The following subsections describe the four stances in detail.

Table 1. Four stances for affordances

	Canonical affordance	Designed affordances	Potential affordances	Affordances as completed actions
Relational ontology	Relation between artifact class and social convention	Relation between designer, artifact, and imagined users	Relation between artifact and actual users	Relation between artifact and actual users
Origin	Social convention leads to canons of affordances	Through design process designers can embed affordances in the artifact	Designed affordances were perceived and actualized. Affordances can be appropriated based on users' perceptions	Affordances actualized as a completed action in a particular context
Role of agency	Shared cultural understanding	Anticipated perception: intuitive design within shared cultural understanding	Perception and action: action is guided by visual cues	Action (including creativity and "unfaithful" use)
Who names	Cultural ancestors	Designer or sponsor	Users and designer	Users who completed an action
Who receives	Anyone	Imagined or actual user	Actual user	Affordances are not received but emerge in performances
When expire	Affordances do not expire (reification)	Affordances do not expire but are either actualized or not	Affordances do not expire but are either actualized or not	Affordances expire after action is completed
Location of affordance	Impersonal, in environment: affordances are universal, defined at the level of a species	Latent in artifacts: potentially cross-contextual, virtually situated in context	Latent in artifacts: potentially cross-contextual, actually situated in context	In active relationships: situated in context
Examples	"Chairs are for sitting"	"I designed this artifact for you to act in a particular way"	"I used an artifact to do a task it is made for"	"I accomplished a task with the help of one or several artifacts"

3.1 Canonical Affordances

Everyday examples of affordances tend to rely on familiar well-established meanings rather than the novel. This tendency can also be found in Gibson [1]:

> If a surface … is … knee-high above the ground, it affords sitting on. We call it a seat in general, or a stool, bench, chair, and so on, in particular. It may be natural like a ledge or artificial like a couch. … Knee-high for a child is not the same as knee-high for an adult, so the affordance is relative to the size of the individual (p. 128).

What is visible in this example is the reliance on a canon. The meaning of a seat, a stool, or a bench is understandable in a relatively similar way by Gibson when he was writing this in the 1970s, by his readers back then, and by us readers now in 2016 and beyond. This refers to Costall's notion of canonical affordances [18, 24].

In the IS context, there are several such canons. For example *email*, *keyboard*, and *spreadsheet*, all provide a sense of affordances. This understanding is not related to a particular artifact, but to the class of artifacts within a shared sociocultural canon.

The strength of this approach is the acknowledgment that certain established sociocultural and organizational meanings remain relatively unchanged over time and space: a car is for driving, a guitar is for playing, an airplane is for flying, and a keyboard for typing. The most commonly used example is that a chair is for sitting [25]. Yet, it is not the contemporary designer of the chair who invented sitting. It is not the clever user who repurposed the tool for her needs. Canonical meanings and purposes have existed long before design and use. In fact, chairs and sitting have a history of several thousands of years [26]. A designer of an instance of a chair merely adopts the already-existing canonical meaning. In this way, the meaning is impersonal [27]. In the context of IT applications, a similar case is with email applications. These afford sending and receiving emails *in general*. It is neither the designer nor the user who established this meaning.

The canonical view adopts normative rhetoric and equates an entity with a canonical action. The affordance *of* stove is that it is *for* cooking. Similarly, boots are made for walking (and in the canonical sense, it is boots in general, not *these* boots).[1]

This correspondent logic is not all that different from the children's play of equating an animal with a sound: a cat says meow, dogs say woof-woof. Canonical affordance directs us to acknowledge the time prior to design *and* action. This point has been articulated by Bloomfield, Latham, and Vurdubakis [22]:

> The 'affordances' of, say, a chair, a post-box or a cigarette are not reducible to their material constitution but are inextricably bound with specific, historically variable, ways of life. We therefore need to better acknowledge what lies beyond the here-and-now timeframe adopted by most analyses conducted in terms of affordances (p. 427).

One consequence of the notion of canonical affordances is its unfalsifiability. It is not a particular person but *one* who sits on chairs [19] or writes letters through email. This makes the affordance objectified and canonical, and thus it cannot be falsified – or at least falsification is extremely improbable. How can one claim that chairs are not for sitting? You can prove that *a* chair is un-sit-able for you, for example, that sitting for

[1] See https://en.wikipedia.org/wiki/These_Boots_Are_Made_for_Walkin'.

extended periods causes you back pain. You cannot say that chairs *in general* are not for sitting. No matter how many instances of chairs you take and prove that you cannot sit on them comfortably, you could spend your whole lifetime trying to prove differently, and still you would not untie the union between chairs and sitting. The artifact and affordances are chained together as Latour [28] stated: "[a] network element with strong properties of irreversibility and effects that transcend time and place."

It is exactly this fixed affordance–object union that critics tend to target. For instance, Jarzabkowski and Pinch [29] note that:

> a chair affords more activities than the designed purpose of sitting, such as being repurposed as a step for reaching a high object, as a lock under a door handle, as firewood when broken, or even, imaginatively, as a shield for modesty, as so aptly illustrated in Lewis Morley's iconic 1963 photo of Christine Keeler in the aftermath of the Profumo affair. Yet, such repurposing, while enabled by the many creative impulses of human action, is not infinite (p. 582).

In summary, this stance attributes the relationship between a class of artifacts and a sociocultural convention. From a temporality view, social convention leads to canonical use of affordances, it rarely expires, and it is relatively universal. Users share the cultural understanding of the affordances that have been established for a long time – in some cases already by our ancestors. Many of the previous studies in IS consider a similar stance where affordances of technology are taken for granted, in other words, affordances are canonical by nature. The main limitation of this stance is when affordance is defined prior to design and action, residing in the objective world, it tends to lose human agency from the analysis.

3.2 Designed Affordances

The second stance, designed affordances, attributes the origin of an affordance to the design process. This stance is prevalent in the human–computer interaction (HCI) field; however, some works within IS also attribute to this stance.

One appeal of the affordance concept has been in its possibility to theorize design. The theory of affordances was adopted into the design field specifically by the HCI community and was introduced by Norman [30]. Gaver [31] formulated that affordances are "special configuration of properties", implying that "the physical attributes of the thing to be acted upon are compatible with those of the actor, that information about those attributes is available in a form compatible with a perceptual system, and (implicitly) that these attributes and the action they make possible are relevant to a culture and a perceiver" (p. 81).

While agreeing that affordances are relational, the HCI community deviated from the Gibsonian concept of the independent existence of affordances by asserting that affordances can be designed into an IT artifact [30]. The concept of "spirit" in adaptive structuration theory – "the general intent with regard to values and goals underlying a given set of structural features" [32] (p. 126) – bears similarities with this stance. In related terms, Redström [33] refers to "*defining use through design*" (p. 413).

Designed affordances have a similar feature (or a problem) as with the previous stance. It has the tendency to unite objects with actions a priori. Any attempt to escape such conceptual marriage tends to result in the generation of "laundry lists of the possible

affordances in objects" [29] (p. 583). For instance, Czarniawska [34] provided eighteen items in a "tentative list of the uses of computers in the workplace" (p. 20), that includes "elements of decoration", "desktop publishing," "scheduling (calendars)", and "objects for unloading aggressive feelings". This laundry-list problem was foreseen by Gibson [1], who stated that "to perceive an affordance is not to classify an object" (p. 134). Citing Wittgenstein, he formulated that "you cannot specify the necessary and sufficient features of the class of things to which a name is given. … You do not have to classify and label things in order to perceive what they afford" (p. 134).

In summary, this stance emphasizes the relationship between designers, artifact, and imagined users. With imagined users we refer to users the designer has had in his or her mind. It therefore refers to a decontextualized environment. From a temporality view, designers embed affordances in the artifact. The affordances exist independent of actual users and never expire, but this is not universal. The affordances can be utilized in a particular situation; however, users should be able to perceive, and the cultural background can influence the perception. Furthermore, the affordances are named by designers in most cases. There are several studies in IS that implicitly fall in this category, although the scholars advocate for perception and actualization of affordances in situ. The main limitation of this stance is when affordance is defined prior to action it discards the possibilities of the emergence of new affordances in practice. The emergent affordances are either named "false affordances" [31] or "unfaithful use" [32]. The third stance described in the next section attempts to address the issues of a priori vs emergence; the third stance somehow reconciles designers' and users' perspective.

3.3 Potential Affordances

Affordances are an ever-present potential for action in the 'potential affordances' stance [35]. The details of its actualization in a specific instance are contingent on aspects of the techno-organizational context, and thus the outcome is indeterminate [36, 37].

Thus, affordances are a type or subset of generative mechanisms. When the object of study is information technology, and the question relates to how the introduction of that technology affects an organization, the more focused nature of the affordance concept is suggested. Affordance exists at what critical realists refer to as the domain of the real. Someone who is capable of performing the actualization must exist for the affordance to have any meaning, but that person need not be identified. "The affordance will not be actualized (brought into the domain of the actual) unless there exists someone who in addition to having the necessary capability also has an intention or goal that is served actualizing the affordance" [37] (p. 822).

One ontological view that supports the potential affordances stance is critical realism [37]. From a critical realist perspective, understanding the organizational effects/outcomes associated with introducing new structures (e.g. new information systems) and how they occur can be viewed as understanding the generative mechanism associated with those structures [38]. These mechanisms are uncovered through *retroduction* [39], a process of working backward from the empirical events we observe to the underlying mechanisms that could logically have produced those events. From a critical realism perspective, affordances arise from the relation between a structure or object

and a goal-directed actor or actors. In IS, critical realism defines affordance as the potential for behaviours associated with achieving an immediate concrete outcome and arising from the relation between the material object and a goal-oriented actor or actors [37].

From the three layers of critical realism, an affordance can be categorized as possessed but unexercised, exercised but un-actualized (or partly actualized), and actualized but not necessarily empirically observed. The critical realism stance tries to find a trade-off between a realist view that affordances exist independent of users and an idealist view that affordances exist in the mind of users [36, 38].

In summary, this stance follows a relational ontology between artifact and actual users (individual or collective). From a temporality view, affordances remain latent until they are perceived and actualized by an individual or group of users, and the affordances can be realized time and time again.

Majchrzak and Markus [35] provided a formulation of the Technology Affordances and Constraints Theory (TACT) in this way:

> One TACT researcher may describe how an organization uses the affordances of electronic communication technology to keep projects going non-stop: At the end of a work day, one co-located team "passes" the project to another co-located team just starting its workday elsewhere in the world. Another TACT researcher may determine that electronic communication technology affords development of shared identity in some virtual teams, while affording the development of enhanced individual self-efficacy in another.

The perception of affordances is influenced by the sociocultural or organizational contexts. Affordances do not expire and they exist in a particular context. Other assumptions are as follows: users have a shared cultural understanding, the affordances are named by actual users and designers, and perceived affordances can be different than the designed ones. This stance seems to be prevalent in the IS context [37, 39, 40].

A counterview for this stance would be that of an ever-changing world. For example, in their book *Sociomaterial-Design*, Bjørn & Østerlund [41] argued that "it doesn't make sense to talk about specific affordances and constraints associated with particular types of artefacts" (p. 93). Instead, their approach emphasizes the entanglement and bounding of objects in human practices. They argue that "any artefact is part of larger and smaller entanglements, and thus bounding, shifting – and sometimes conflicting – affordances and constraints may be associated with the same artefact. This means that there is no direct causal link between the artefact and particular affordances and constraints". This stance counts potential action as affordances; on the other hand, the fourth stance discussed in the next section regards affordances as a completed action and doesn't consider perceived or latent affordances in its valid list.

3.4 Affordances as Completed Actions

The fourth stance takes an enactive approach [42], which understands affordances as completed actions within social practices. This view can be seen as rooted in pragmatism and builds on Shotter's [43] definition that "an affordance is only completely specified as the affordance it *is* when the activity it affords is complete" (p. 27). A consequence

and a major advantage of this approach is that it is by far the most relational and co-constructive of all these stances. A focus on completed actions includes the conventional and the novel, the routinized and the experimental [44]. Costall and Richards [45] referred to this type is the following way (p. 91):

> In such cases, affordances are not simply discovered, but nor are they mentally projected upon inherently meaningless things. They are negotiated. In such cases, the verb "affording" rather than the noun "affordance" is, therefore, by far the more appropriate term.

Therefore, a major deviation from other stances here is the rejection of realism – in other words, the idea that affordances are "out there". While realists would argue that affordances are *seen*, in the pragmatist and enactivist perspective affordances are *seen as* [42]. Flint and Turner [42] argued that this view attributes a "tight coupling between perception and action" (p. 48), so that "perception involves active exploration of the world rather than interpreting the patterns of light falling on the eyes" (p. 47).

When Gibson was in his early twenties, he was influenced by "two of the most radical intellectual movements of the early twentieth century, … pragmatism and Gestalt-phenomenology" [46] (p. 51). Of these two streams of thought, the American pragmatism of William James promoted antidualism – a central idea later adopted in the theory of affordances. William James was one of the central sources of inspiration for Gibson [46–48]. However, Noble [49] observed that Gibson was "impatient with philosophy" (p. 65). Hence, Gibson "neglected (rather than overlooked) the pragmatist perspective", causing pragmatism to be a "*tacit* … not *reflexive*" aspect of affordance theory (p. 66).

We can take the example from Jarzabkowski and Pinch [29] of a chair that is used as "a shield for modesty" (p. 582). Using a chair in this way is not a canonical affordance. Chairs are canonically made for sitting, not shielding for modesty. It also was not designer Arne Jacobsen's "spirit" that made this affordance the affordance it is. The chair was used creatively in a photographic shoot. This photograph helped in journalistic purposes to visualize the sexual scandal story between the 19-year model Keeler and a high-profile politician and is said to be a major contributor to the financial success for Arne Jacobsen's model 3170 chair. In the photo, the chair was part of the affordance relationship but not as a readymade affordance that was *seen*. It was *seen as* [42]. It was a co-constitutive element in the process of affording.

As another example, we can take practice-oriented studies of paper use in the office environment [50]. Yli-Kauhaluoma, Pantzar, and Toyoki [51] identified how paper affords six practices: social coordination, remembering, anticipation, sketching, modeling, verifying, and back-up practices. But where do these originate from? Is it the inventor of paper who prescribed that paper affords to "get ready for a particular task in the very near future" (p. 72) in an office setting? Unlikely. Such aspect is not a canonical feature of paper either. These affordances are results of creative co-construction between the paper and its users. It requires the *seeing* of paper *as* something meaningful within a social practice.

Researchers who seek explanatory and predictive theories (e.g. [52]) may see the completed action stance as limiting. This is due to the research focus that is put on actions already completed, as the name suggests. It is therefore in tune with Kierkegaard's famous proverb: "Life can only be understood backwards; but it must be lived forwards".

Researchers aligning with this stance will adopt the affordance concept as a sensitizing device in constructing how particular people in a particular setting are able to accomplish what they do.

In summary, this stance sees the ontological relationship between an actual artifact and actual users (individual/collective) in a particular context. The artifact is embedded in social practices in which the affordance is achieved through action. From a temporality view, affordances emerged in practice and cannot exist independent of users. However, the affordances are not just about perception or emergence but should be a completed action. The affordances in this stance expire after the completion of the task. Furthermore, users name the affordances. There are few studies in IS that fall into this category. The main limitation of this stance is not considering the perceived affordances as affordances. In reality, a perceived affordance can be realized in the future. Likewise, it does not give a proper account to the designer's intention and material properties.

4 Concluding Discussion

The concept of affordance has entered IS research in many ways and has mostly been used to help understand and theorize some types of sociotechnical phenomena [4–6, 37]. Recently, Majchrzak et al. [7] stated that affordance theory is "particularly well suited to help IS scholars build theory about ICT use" (p. 272). Some researchers have developed theoretical affordance models [37], while others have studied associated affordances with various types of IT solutions [40, 53]. Yet others have taken the affordance concept as casual vocabulary, seeing no need to refer to Gibson or others [54].

In this paper, we have reflected on the uses of the affordance concept in IS research. This quest fits Czarniawska's [55] recent call for reflexivity in research, a task that often requires "conceptual cleaning" (p. 4). She argued that our analytical concepts often have "ceased to do their analytical work and became blunt tools" (p. 3). We suspected that the affordance concept has become a blunt tool with it referring to various types of phenomena that are seemingly similar yet different.

Affordance is a relational concept, but it is not clear what this "relation" is. We have demonstrated this through the four stances presented in this paper. Affordance theory promises to be of great value for the field of information systems. What are the implications of the four stances for future research applying this concept? We assume the concept will endure and evolve together with the developments within our field. Compared to the HCI and socio-technical perspective, affordance theory addresses another aspect surrounding the use of technology. Affordance theory aims to understand the relationship between the object/technology and the human actor using it. By focusing on this relationship, shown in Fig. 1, affordance theory may help us create a nuanced picture of how technology affects the human actor and the usage of technology.

When the IS community adopted the concept of affordances, it retained its relational characteristic. In the IS literature, there is considerable debate on the ontological understanding of affordances [56]. The debate centres around the question: are affordances embedded in the artifact or do they emerge in practice. As indicated above, the relational ontology from the design perspective claims that affordances

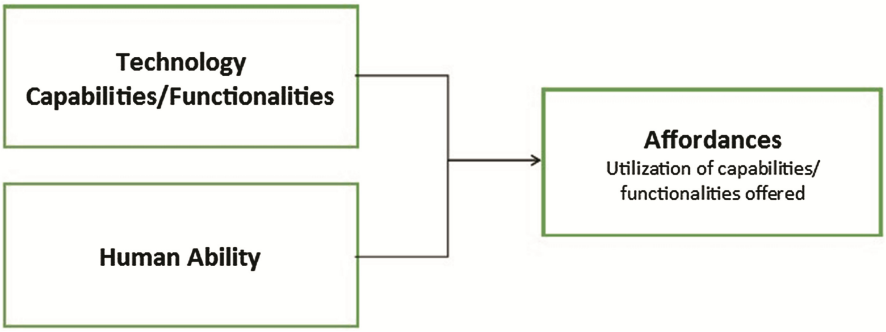

Fig. 1. Existing IS stance on affordances (adapted from [59]).

can be designed [57]. In designing an IT artifact, designers keep an imagined user in their mind, although the context might be blurry [47]. Thus, affordances are embedded and exist independent of the user, but affordances have an impact only if the user perceives and actualizes them. By contrast, a use perspective of the relational ontology suggests that affordances emerge in practice in a particular context [58].

We argue that the third stance is the most popular stance in IS research thus far (e.g. [37, 39]). However, the perspective on "relational and temporal" ontology is singular. Singular in this context means, as shown in Fig. 1, material properties (or technology capabilities/functionalities) exist together with goal-directed actors with abilities, and affordances emerge out of their relationship. Looking at the boxes of "relationship" and "affordances", it seems that the nature of relationship and affordances is singular.

Our study reveals that the conception of a "relationship" is rather complicated in affordance theory. For example, the relationship can be between a class of an artifact and a social convention; among designer, artifact and imagined users; between artifact and actual users; or between an artifact and another artifact. Furthermore, we realize that the temporality of affordances is rarely discussed in IS literature. The questions need clarification: Do affordances already exist "out there" and are actualized? Do they emerge in a sequence of perception and actualization? Or is affordance a result of a negotiated action that is successfully completed? This paper contributes by digging deeper into these issues and provides four stances to illustrate the multiple natures of that relationship and temporality of affordances. As mentioned earlier, we have not aimed to identify the "proper" stance when using affordance theory. However, we do stress the importance of being aware of the consequences of making a choice of stances when applying affordance theory in research.

Fifteen years ago, Orlikowski and Iacono's [60] study unfolded the singular view of the IT artifact and suggested multiple views: tool, proxy, ensemble, computational, and nominal. Our study took a similar approach in revealing multiple stances of affordances. In this paper, however, we haven't considered how multiple views of the IT artifact relate to multiple stances of affordances. This study is more focused on clarifying the relational and temporal ontology of affordances. We realize that the discussion of affordances without taking the IT artifact into account might not present the whole story.

Therefore, exploring the link between different views of the IT artifact and four stances of affordances may be worthwhile to investigate in the future.

The implications of the four stances of affordances for further research are as follows. With regard to the first stance, it is worthwhile to explore the sociocultural setting preceding the current time of design and action. The notion of canonical affordances also requires us to explore how something *canonizes*. How does the artifact–action relationship become a canon? And how to break away from it if the canon has become a burden? In the second stance, researchers can explore how designers embed affordances in material properties and how their intention becomes appropriated in use. From the perspective of the third stance, researchers can study the process by which affordances have been perceived and actualized, and how multiple affordances emerged. The perception/actualization of affordances by individuals or collectives will also be a topic of interest. Based on our observations, most of the existing studies in IS fall in the third stance. Similarly, researchers in the fourth stance can look into how affordances occur in situated completed actions; there is a lack of such studies in IS.

Finally, temporality is an important avenue for future investigation. Involving time in the analysis will help us notice the "different *moments* in the unfolding biography of the artefact" [22] (p. 429). Taking a dynamic affordance perspective will probably require both longitudinal and comparative research designs in empirical studies [61, 62]. Temporally and contextually sensitive analysing includes *actors* and *artifacts* in a process of *affording* [45] (p. 91). It is also important to maintain all these components throughout the period of investigation and in reporting [63].

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Considering Communication and Performance

A Relational Approach to Materiality and Organizing: The Case of a Creative Idea

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Abstract. In this paper, we propose to go beyond the notion of entanglement that has been proposed in recent years to fill the so-called gap between "the social" and "the material", especially in organizational studies. While this notion rightly invites us to reconsider the way we traditionally approach the question of materiality and organizing, we believe that its formulation tends to implicitly reproduce the gap it claims to fill. In contrast, we propose a view according to which sociality and materiality should, in fact, be considered *aspects* of everything that comes to be and exist. Throughout the analysis of an episode taken from fieldwork devoted to creative teams, we show that things as abstract as ideas, for instance, in order to emerge, exist, and continue to exist, have to materialize themselves in various identifiable beings. While the sociality of an idea is identified through the various relations that make it what it is, we show that its materiality comes from what precisely materializes these relations.

Keywords: Relational ontology · Aspectuality · Communication · Materiality · Organization · Sociomateriality

1 Introduction

In keeping with the existent literature on sociomateriality (especially [1]), we refute the distinction between, on one side, a material world, and on the other side, a social world. However, we believe that the concept of entanglement, as proposed by Barad [2] and taken up by Orlikowski [3], unfortunately implies the idea of things – for instance, meaning and matter [2] or sociality and materiality [4] – being wrapped or twisted together, which implies that their ontological distinction is still maintained even if their entanglement indeed makes this distinction difficult to make. This language problem has been mentioned by Orlikowski herself [4], but also by Kautz and Jensen [5] as well as Cecez-Kecmanovic [6].

With the notion of aspectuality, which we propose and explain, we show that materiality and relationality (a term we prefer, as we will explain, to sociality) should, in fact, be considered aspects of everything that exists, whether we are talking about emotions, ideas, discourses, practices, institutions, computers or rocks. If this position is compatible with the *relational ontology* defended by Barad [2] and Orlikowski and Scott [4],

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we believe that it allows us to specify the nature of this ontology by clarifying what we mean by matter and what we mean by relation.

Having established our position, we then examine what it implies for the CCO (Communication as Constitutive of Organization) approach [7–9] in its various forms [10], that is, the view according to which organizations and, more generally, reality itself [11], should be considered as *communicatively constituted*. As we will show, the CCO approach should not only be considered compatible with this material turn, but allows tackling the questions of materiality and relationality in a manner that is at once practical, embodied, and dynamic.

We then illustrate our approach by analysing the pitch of an idea during a creative event called Museomix. In our analysis, we identify the various beings (among them a stage, people, words, gestures, paintings, a wooden board, languages, expectations, etc.) through which this idea materializes. In other words, we show how this idea emerges when these various beings start relating to one another.

2 Sociomateriality: Weak and Strong Versions

For the last ten years, organization studies have taken what has come to be known as a *material turn* [12–14], a turn that had already started in other areas of the social sciences and humanities, from gender studies [15], to science and technology studies [16, 17], and to Deleuze's [18] and Foucault's philosophies [19]. This turn, which centred on the key notion of sociomateriality [3], can be roughly defined according to two main research programs, which defend weaker and stronger versions of sociomateriality [20].

According to the weaker version, rethinking materiality essentially means acknowledging that objects, bodies, technologies, artifacts, architectural elements, and apparatuses of all sorts play a full part in the existence and reproduction of routines and organizational processes. This movement, mainly represented by Paul Leonardi's [21, 22] seminal work, therefore amounts to recognizing that we cannot reduce organizational phenomena to processes of sensemaking, as Karl Weick [23, 24] or Linda Putnam and Michael Pacanowsky [25], in their time, invited us to do. We also have to acknowledge the differences that artifacts, technologies, and apparatuses make in these routines and processes, what Leonardi identifies, echoing Pickering [26], as a form of *material agency*.

Leonardi's [21, 22] approach to sociomateriality indeed consists of showing that the two elementary building blocks of organizations and technologies are, on one side, human agency, which is goal oriented and therefore marked by a form of intentionality, and, on the other side, material agency, which is almost always identified with *what technologies do* and is devoid of intentionality. These two agencies are presented as articulated according to two main sociomaterial imbrications – human → material and material → human – that characterize the evolution of any technological implementation and, more broadly, of any organization.

Although this approach explicitly "denies any separation of technology from organizing" [22] (p. 41), the notion of imbrication "allows for maintaining the distinction

between social and material agencies with respect to intentionality while still recognizing their synergestic interaction" [22] (p. 46). According to this version of sociomateriality:

> as people attempt to reconcile their own goals with a technology's materiality they actively construct perceptual affordances and constraints. Depending on whether they perceive that a technology affords or constrains their ability to achieve their goals they make choices about how they will imbricate social and material agencies [22] (p. 50).

The connection between the social and the material is therefore essentially a matter of imbrications, which are very nicely analysed by Leonardi [21, 22] in his ethnography of a case of computer simulation technologies for automotive design. It is, however, noteworthy that in this case, materiality is essentially identified with technology, that is, whenever this author talks about material agency, his illustrations tend to always take the form of technological agency; what differences technologies make in specific situations. In contrast, whenever he talks about social agencies, he actually implies human agencies, which, for instance, take the form of specific routines, conducts, and conversations.

Leonardi's approach to sociomateriality thus is that the elementary building blocks of organizations and technologies are human/social agency and material/technological agency. We believe that this approach (as fruitful and interesting as it is) presents two limitations:

1. Human/social agency seems to exist independently from materiality, while it may be argued that it is made up of material elements.
2. Once something during fieldwork has been labelled an elementary building block of phenomenon (either human/social or material/technological agency), it seems that we cannot further decompose this thing, thus preventing us from gaining potential new insights in the phenomenon under study.

In contrast with this approach, there exists what we could call a stronger version of the sociomaterial thesis, where the material turn goes beyond the simple recognition that (a) we live in a material/technological world to which we, the humans, need to adapt our goals and that (b) this world makes a difference in the way we organize ourselves, especially in the case of technological implementations. According to this other version, mainly represented by Barad's [2] as well as Orlikowski and Scott's [1, 4] work, there is no cut, break, or bifurcation between materiality and sociality, which ultimately means that the distinction between social and material agencies cannot be maintained.

In contrast with Leonardi's notion of imbrication, Barad [2] thus proposes the notion of entanglement, a notion taken up by Orlikowski [3, 4], that is supposed to mark the *constitutive entanglement of meaning and matter*. One of the reasons that make this notion difficult to present is that it was sometimes misrepresented by the very authors who adopted it. Indeed, in their first articles on sociomateriality, Orlikowski and Scott [3, 4] tended to present this "constitutive entanglement" as meaning that humans and non-humans (in particular technologies) could not be ontologically separated, an idea that was then harshly criticized notably by Faulkner and Runde [27], Mutch [28], and Leonardi [29].

As these latter authors argued, while most people would likely agree that it is impossible to have, for instance, meaning or humans without any form of matter involved, it seems, however, a lot more difficult to agree that it is impossible to have matter without meaning or humans. Does this mean that when the moon is not connected to some sort of discourse or meaning it does not exist? Is it to say that people produce the entire world when they speak about it? This idea surely sounds like a caricature of constructivism.

However, this is not what Barad [2] and Orlikowski, in her subsequent articles [1], mean because they develop what Barad calls a "posthumanist" approach to discourse and meaning. For them, discourse and meaning do not necessarily involve humans or human action. When a tree falls, this event is already in itself meaningful and discursive (i.e. even if no human is there to see, hear, and speak about it) in the sense that the tree and the ground *communicate* their existence to each other, for instance through the vibrations that run through them on impact.

Thus, through the change that they undergo, the tree and the ground become related and meaningful to each other. The idea, in other words, is that the elements of the world somehow "communicate" to one another in their own special way; a position that we also find in the work of the anthropologist Eduardo Kohn [30] when he shows how forests can be said to think. Now, what are Barad and Orlikowski trying to accomplish with this posthumanist understanding of discourse and meaning? Their point is to show that contrary to the way it is usually defined, matter is not something that sits still. Regardless of how much a given piece of matter appears to be stable, its stability is always the result of a particular configuration of things; meaning that if this configuration is not maintained, the stability disappears.

Put another way, there is nothing in this world that inherently possesses its properties. Every being, entity, or phenomenon acquires its properties by relating to other beings, entities, or phenomena (an idea we also find in Latour [31, 32], Law [33], and Pickering [26]). This *relational ontology* [34] has an interesting epistemological consequence: it means that any being, entity, or phenomenon – regardless of how elementary or solid it might look – can theoretically be broken down into a web of relations between various beings, entities, or phenomena. This approach, it seems, allows overcoming the theoretical and empirical limits related to the division of the (organizational and technological) world into elementary units of human and material agencies, as proposed by Leonardi [21, 22].

However, we cannot help but notice the high "cost" of this solution. There are two issues that make this solution particularly difficult (or "costly") to communicate and work with. The first issue, as already mentioned, is that Barad's and Orlikowski's approaches rely on a posthumanist definition of "discourse" and "meaning", which tends to contradict the common use of these terms (that are usually associated with human-related phenomena). This approach can thus be easily mistaken for a form of radical constructionism. The second issue concerns the ambiguity of expressions such as "the constitutive entanglement of meaning and matter" or expressions such as "material discursive practices", which both authors keep using in their respective work (see also [4–6] on this language problem).

By definition, "entanglements" involve elements that, although closely interlocked, can be ontologically separated. It follows that the very word "entanglement" tends to

defy the inseparability that Barad and Orlikowski have in mind when speaking about the *constitutive* (or *ontological*) entanglement of meaning and matter. A similar remark can be made about the expression "material discursive practices" where the juxtaposition of the adjectives "material" and "discursive" invites the idea that there might be "material practices" on one side and "discursive ones" on the other and that they sometimes come together. Here again, the words seem to resist or defy the idea.

Although the notion of entanglement should definitely be considered an improvement, as it explicitly invites us to reject the separateness of the material and social worlds (see especially [1]), we believe that it tends to be misleading as it invites us to still take for granted the existence of two things, however entangled/twisted/wrapped together they might be at the ontological or constitutive level. Entangling indeed means to "cause to become twisted together with or caught in" (Oxford Dictionary), which means that the notion of entanglement presupposes, by definition, the existence of worlds or things – for lack of better words – that are indeed twisted or wrapped together.

Even if Orlikowski and Scott's [1] most recent analyses cannot be accused of reproducing this implicit divide, the first formulations that Orlikowski [3] proposed to conceptualize the notion of entanglement – which happens to be the one that the literature retains and comments on [20] – tends to be problematic. This is, for instance, what happens when she writes, "the social and the material are considered to be inextricably related – there is no social that is not also material, and no material that is not also social" [3] (p. 1437), a formulation that implies that there is something called "the social" and something called "the material" that are both entangled at the constitutive/ontological level.

3 Sociomateriality: An Aspectual Version

In contrast with this formulation, we believe that we need to go one step further by recognizing that speaking about "the social" on the one hand, and "the material" on the other hand, does not make a lot of sense; even if we consider the entangled or imbricated aspects of these two worlds [35]. In keeping with Orlikowski and Scott [1], we certainly claim that there are no such things as a material world – the world of tables, rocks, technologies, buildings, etc. – on one side, and a social world – the world of words, interactions meanings, cultures, emotions, and ideologies – on the other. Words, interactions, meanings, cultures, emotions, and ideologies are always already material, while rocks, tables, technologies, and buildings are always already social (in a posthumanistic sense).

According to this *third version of sociomateriality*, sociality and materiality should be considered two different and intractable aspects of everything that comes to exist and be [36]. By focusing on the material aspect of something or someone, we highlight *what sustains its existence*. Indeed, matter comes from the Latin word *materia*, which means "the substance from which something is made", where substance means "what stands [stare] under [sub]" something or someone [37] (p. 301). This explains why something as abstract as an emotion, an idea, or even an intuition has to materialize itself in one way or another in order to exist [38].

It does not mean that all entities have the same degree or level of materiality (some entities – e.g. rocks for instance – can indeed appear to be more material or concrete than others – e.g. an idea, when it crosses somebody's mind). However, it means that *materiality is an intractable aspect of everything that exists* and that this notion should therefore be understood *relationally*. In other words, the materiality of something or someone expresses the *relation of sustainability* or *supportability* that specific elements have vis-à-vis the existence of this thing or person. This way of defining materiality relationally thus allows avoiding the pitfall of looking for matter in an absolute way. *Matter is always as such in relation to what it materializes*.

In contrast, focusing on the *social* aspect of something or someone means that we focus on the *relations* it/he/she is literally made of, that is, the relations that connect it/him/her with other beings. As Latour [31] reminds us, the term "social" indeed comes etymologically from the Latin *sequor*, which means "to follow" – a word that also gave the Latin *secta*, which means a line of conduct, way of life, or principle, and is the root of the English word "sect" [36]. Speaking about the social aspect of something or someone thus amounts to referring to what relates this thing or person to other beings. For human beings, this would be, for instance, the principles, lines of conduct, or ways of life they tend to follow collectively, while for an emotion, it would be what triggered or caused it (an event, for instance), but also what this emotion is itself triggering or causing (a reaction, for instance).

Sociality and materiality are indeed related to each other, but these two notions invite us to analyse someone or something under *two different aspects*: if we focus on the *materiality* of a given being, we also focus on the other beings that compose its existence. For instance, an organization is literally made of its spokespersons, employees, website, contracts, operations, buildings, products, discourses, knowledges, atmospheres, cultures, spirits, customers, stakeholders, reputation, etc., which can all be defined as its properties [39–41], knowing, of course, that each of these element is itself/herself/himself made of other elements that compose its/his/her existence. The notion of materiality thus invites us to focus on what sustains the existence of anything or anyone, even when this thing or person appears to be outside of this thing or person (this is the case, for instance, with customers or stakeholders of an organization).

If, in contrast, we focus on the *sociality* of a given being, we will then concentrate on the *relationships* that compose its/his/her existence, that is, the fact that its/his/her components or properties are themselves related to one another (they form a configuration). In other words, this being is itself/himself/herself caught in a web of relations with other beings. For instance, if an organization is made of its spokespersons, employees, website, contracts, operations, buildings, products, discourses, knowledges, atmospheres, cultures, spirits, customers, stakeholders, reputation, etc., it is also because these elements are themselves related to one another.

As an illustration, we could point out that if an employee can be said to materialize an organization, it is because, among other things, she signed a contract with this organization, she has been authorized to speak on its behalf, she supposedly knows how to speak about its products, and she talks to customers on the phone (for whom she embodies the company at this moment); that is, because she relates this organization to various beings or entities. If the customers feel that their concerns have been addressed,

they will possibly come out of this conversation with a good impression of this company, an impression that will itself participate in its constitution/materialization. This customer might then speak favourably about this organization to relatives, friends, and acquaintances, who will themselves participate in its reputation.

The representatives an organization has, the way it speaks through them to customers, the impression it leaves to these very costumers, the reputation it is able to build through these exchanges, and the customers it is able to keep through these experiences can all be considered *properties* of this organization. However, these properties, which materialize the organization, are, as we see, relational. That is, they depend on the *relations* that come to establish what constitutes the organization. This is why Derrida [42] notes that any property is, to some extent, improper, precisely because it cannot be absolute: it depends on a relation in order to exist, what Latour [32] would also call a sort of "plug in".

The social and material aspects of something or someone are therefore inseparable, not because they are entangled at the constitutive level, but because they represent *two ways by which something or someone gives itself/himself/herself to be experienced*, which is what we mean by "aspect". An organization materializes itself *through* this employee and her discourse (two of its properties), but also *through* the way it is experienced by the customer as well as through the reputation it will develop over time (two other properties). In contrast, the relationality (or sociality) of this organization is precisely expressed by the preposition "through", which marks the network of relations this organization needs to go through in order to express itself.

As we see, any materialization (a spokesperson, a discourse, a customer, a stakeholder) of a given being (an organization) is always already a relation between this being and other beings (a spokesperson speaking to a customer, for instance). Conversely, any relation (between an organization and its customers, for instance) is always already a materialization of a particular being (an employee speaking on its behalf to a customer, for instance). In other words, and this point is crucial in our demonstration, any being always constitutes itself/himself/herself a relation between other beings, which also means that any relation is material, that is, it has to materialize itself in something or someone.

Speaking about the sociality and materiality of something or someone does not amount to speaking about the same aspect, which means that these two terms are not, strictly speaking, synonymous. While the sociality of something or someone insists on the relations/configurations that compose its existence (whether internally or externally, knowing that the distinction between what is inside and outside can, of course, itself be problematized), the question of materiality insists on the various elements that can be identified as participating in these relations/configurations, knowing that these elements can themselves be seen as the materialization of relations.

For instance, an organization both materializes and socializes/relates itself through an employee talking on its behalf to a customer. However, its materialization will be expressed through the employee, what she is saying, and the impression the customer will come up with based on this experience (among many other things), while its socialization will be expressed through the relations that compose these materializations: a customer talking on behalf of the organization, what she is saying on its behalf, or what

the customer retains from this conversation (good or bad impressions). Any relation is therefore made of something or someone (it has to materialize itself in something or someone), and any materialization itself consists of relations that make it possible. The material and social aspects of something are thus somewhat unique in the sense that, although irreducibly different one from the other, they cannot present themselves one without the other.

To put it another way, although the notions of sociality and materiality define and constitute each other in our sociomaterial approach (in this respect it is no different from Orlikowski and Scott's [1]), the particular backgrounds or histories that characterize each of these notions never entirely disappear (this is where our approach perhaps departs from Orlikowski and Scott's [1]). They remain present in our sociomaterial (re)definition of materiality and sociality (in the sense that one is necessary for the definition of the other) and they are always likely to make a difference in our analyses, in the sense that the vocabulary related to matter (materialization, substance, etc.) will tend to direct our attention to what supports or constitutes given beings while the vocabulary related to relations (connections, networks, etc.) will tend to direct our attention to what flows or circulates between and through them.

We believe that our job, as sociomateriality analysts, is to empirically show that whether we use one or the other of these vocabularies, we end up describing the same beings or phenomena. While we do not have to systematically do this in our analyses (in the sense that we do not necessarily have to conduct our analyses by first using one vocabulary and then again using the other), we can regularly signal the possibility of using both vocabularies, either by mixing them (e.g. by saying that something "*materializes through*" something else) or by juxtaposing them (e.g. by saying that something "*materializes in, that is, flows through*" something else).

4 Communication as Constitutive of Organization

Given the role questions of sociomateriality have played for the past ten years in the development of the CCO literature [7–9, 38] in its various forms [10, 43], we now propose to explore to what extent this aspectual conception of sociomateriality can be deemed compatible with the idea of organizing and organization as being communicatively constituted [44]. At first sight, one could think that the material turn (in its three versions) disqualifies these constitutive approaches to the extent that the latter, by putting the emphasis on communication in organizational processes, would be ill equipped to account for questions of materiality.

We would like to show that these constitutive approaches – in particular those associated with the so-called Montreal school [9, 11, 41, 43, 45–48] – are not only compatible with this material turn, but that they allow tackling the aspectual approach to sociomateriality we just introduced in a manner that is at once practical, embodied, and dynamic. To this end, we propose to follow the aspectual view by taking as our starting point the etymology of the word "materiality" to show that mentioning the materiality of something (or someone) always amounts to showing that this thing (or person) is made,

constituted, or composed of elements/properties that can be experienced as related to each other.

From a CCO perspective, focusing on the communicative dimension of organizations aims to show that organizations are embodied, materialized, and incorporated in various beings whose effects can be analysed (this thus amounts to focusing on the material aspect of any organizational form). It also means that our analyses should not only focus on what these beings do but also on what they express, translate, or reveal (that is, on what passes through them), which expresses their relational character. In other words, we should conceive of them not only as actors but also as passers [35]. To study communication processes therefore amounts to analysing these *passing or relational effects* through which a given being (a human being, a technology, an architectural element, a document, etc.) expresses, translates, or reveals other beings, thus becoming their spokesperson, representative, translator, or *materializer*.

If we turn to the study of organizational interactions, we notice, for instance, that words, gestures, glances, and intonations are always the expression of a true polyphony that Bakhtin [49, 50] had already outlined [51], but this should be extended to artifacts, emotions, cultures, and ideologies (among other things). Therefore, to analyse communication is not to bracket the material world precisely because it involves resisting the temptation to singularize this world by separating it from the world of speech, for instance. *Materiality should rather be conceived of as an irreducible aspect of everything that is, including speech and any communication act in general.*

This is why there is not, on one side, a material world (the one of chairs, computers, walls, etc.) and, on the other, an immaterial/social world (the one of thoughts, emotions, discourse, speech, cultures, ideas, etc.). On the contrary, if something (or someone) exists, it is always because it materializes itself in one way or another, whether through the form of a website [1, 11, 36], a spokesperson [40], a number [52], a look [41], etc. through which a relation is established. Materiality and immateriality should thus be conceived of relationally; that is, in terms of degrees. Things and beings will always *more or less* materialize in a given situation, through a discussion, an experience, or a feeling (among other things).

Advocating a constitutive approach to communication therefore involves going back to the very definition of a communicative act, namely the act through which a being A enters in relation with a being B through a being C, a triadicity that Charles Sanders Peirce [53] had noticed and that can be applied to *any* communicative phenomenon, whether we refer to two rooms communicating (through a doorway), machines interacting (through channels and data), or people conversing (through intonations, gestures, looks, and words). Most importantly, it is to recognize that A and B, identified as the origins and recipients of these communicative acts, are *also always already* intermediaries themselves, in other words, potential beings C', through which other beings A' enter in relation with other beings B'.

Speaking in terms of communication rather than in terms of discourse and meaning thus allows us to highlight the *relational* nature of our world without resorting to concepts that have been traditionally associated with a human-centred perspective. It does not mean that discourse has to be banned from our vocabulary; it simply means that discourse is just one way through which communication happens [46]. Two rooms

do not converse with each other, but they might indeed communicate. The same thing could be said of the tree and ground we talked about earlier.

Studying the organizing property of communication therefore amounts to showing how various beings articulate themselves (in both senses of the word: enunciating and assembling) so that they become the intermediaries, materializers, or media of one another, and that the ensuing collective action becomes that of a collective body. As a result, we also find the etymology of the term "to organize", which comes, as we know, from the Greek term "*organon*", which means "instrument" and therefore, intermediary. Getting organized or organizing ourselves means becoming the instrument, intermediary, passer, medium of a (more or less collective) action that will materialize and express itself through our contributions; contributions that will in turn materialize and express themselves through other beings (procedures, programs, protocols, titles, status, rules, spaces, temporalities, etc.).

To follow the process of organizing, as Bruno Latour [32] and Karl Weick [23, 24], each in his own way, invited us to do, therefore, amounts to accounting for the performances through which beings act as instruments or intermediaries to produce and express a body that may or may not articulate itself *for another next first time*, as Garfinkel [54] nicely puts it. This is the research question that the current material turn invites us to address. At the analytical level, this means that we can no longer merely identify the acts that people produce in interaction, but that we have to extend this agency – this capacity to act – to all the beings for which these same people act as spokespersons, intermediaries, media, and materializers.

Analysing the organizing properties of communication thus means that we can restitute, for instance, the properties of something as seemingly abstract and immaterial as an idea, that is, the way it materializes itself in a specific situation by the establishment of relations. In the rest of this paper, we propose to perform a detailed analysis of the pitch of an idea to illustrate our CCO position regarding this material turn. This pitch happened during a creative event called Museomix that took place in November 2014 at the Fine Arts Museum of a major North American city. Our analysis of this pitch will consist of detecting the moments where various beings (among them a stage, people, words, gestures, paintings, a wooden board, languages, expectations, etc.) became the instruments, media, passers, and materializers of the properties of a particular idea; an idea that, as we will see, came to exist and materialize more and more through these enactments.

5 Method

The analysis presented below is a (small) portion of a larger research project aimed at developing a communicative approach to organizational creativity. For this project, we observed and video shadowed [55] several activities aimed at collectively producing something innovative, such as brainstorming sessions and creative events, among them Museomix. Museomix is a yearly "creative event" that happens simultaneously in several museums around the world. For three days, 60 to 80 participants of various backgrounds (including art historians, graphic designers, software developers,

entrepreneurs, etc.) meet in each participating museum to prototype new ways of experiencing the museum. As mentioned above, our study focused on the part of the event that took place in November 2014 at one of these museums, located in a major North American city.

For the three days of the event, we shadowed and videotaped the activities of two teams of participants (comprised of six members each), from the moment the teams were formed to the moment they presented their prototypes to the visitors of the museum. We also collected various documents that were used for organizing the event, including snapshots from Museomix's website and copies of the participants' handbook. Using the qualitative analysis software *Transana*, we then watched the videos, created a content log for each video file, and transcribed passages where the ideas developed by the participants seemed to undergo significant changes. We used Jefferson's transcript symbols [56] for the transcriptions.

We then analysed the transcribed passages. Our process of analysis can be described as follows: for each passage, we detected the relations through which an idea materialized itself by acquiring specific properties (starting with that of being an idea). In other words, we detected the configurations/relations through which various beings became the instruments, media, passers, and materializers of the properties of an idea. As already mentioned, these beings could have been of various natures (e.g. words, gestures, architectural elements, emotions, documents, rules, etc.). They could also have been more or less readily observable. Thus, while some beings were clearly identifiable at the moment they contributed to materializing an idea (e.g. the words "our idea is…"), others were contextual elements (e.g. requirements of the event) that contributed to the materialization of the idea at a distance by framing the participants' speeches and actions in a certain way.

As already mentioned, the analysis below focuses on the moment where one of the teams we followed "pitched" their idea in front of the other Museomix participants at the beginning of the event. To help our reader follow our data analysis, we divided the analytical section into two parts. In the first part, we present the requirements that participants were supposed to meet when pitching their ideas. These requirements were communicated to the participants in three main ways: through (a) Museomix's website, (b) the participants' handbook, and (c) instructions given by the organizers over the course of the event. In the second part, we analyse the pitch of the idea using elements from the transcript of the pitch and from the pitch requirements.

6 The Pitch Requirements

There were two main requirements that participants were supposed to meet when pitching their ideas: those that concern Museomix as a whole and those that concern the pitch specifically. While these various requirements can be regarded as particular materializations of Museomix (in the sense that they are elements through which Museomix expresses itself), this is not why we focus on them here.

We do so because they happen to materialize the properties that participants' ideas are supposed to acquire during Museomix. In other words, they are the properties that

participants are invited to connect to one another while expressing their own ideas. In short, they are the peculiar form of existence that ideas have in Museomix before any participant expresses any idea. In the analysis below, we aim to identify not only these requirements, but also the various beings (organizers, texts, web pages, speeches, rooms, wooden signs, technologies, etc.) through which they materialize, that is, the particular configurations of relations through which these requirements happen to pass and express themselves. In that respect, we present the beings (organizers, texts, etc.) that materialize the beings (the requirements) that materialize the way participants' ideas should materialize (during the pitches).

6.1 Requirements for Museomix as a Whole

One of the key requirements was that participants had to *develop creative ideas*. This requirement can be derived from the way Museomix defines itself, whether it is on its website, in the participants' handbook, or in the organizers' speeches. For instance, one of the calls for participants available on Museomix's website reads: "Museomix is a lab for reinventing museums … For three days, museums transform into sandboxes to create new experiences for the public" (our translation, museomix.org/appel-a-participants-2015, 2016-01-22). As we understand from this quote, Museomix (through its organizers and website) expects the participants to be "creative" in the usual sense of the term, that is, to "show an ability to make new things or think of new ideas" (Merriam-Webster online dictionary).

As the same quote indicates, participants are supposed to use their creativity for one particular task – "reinventing museums". To help the participants figure out what this means, Museomix devised what they call six "grand challenges", which are supposed to materialize these particular expectations: "Showing the un-showable", "Renewing the visitor's experience", "Behaving in the museum", "The museum and the senses", "Copyrights in the museum", and "Business development at the museum". Museomix organizers do not tell the participants how they are supposed to respond to these challenges (this is precisely where they are supposed to be creative), but they ask them to *indicate the one challenge to which they intend to respond*. To this end, before pitching their ideas, participants had to write down their team name as well as "their challenge" on a wooden sign (see Fig. 2 below). If their idea was selected, the wooden sign would serve to identify the working space of their team for the rest of the event.

Another basic requirement of Museomix was to *turn ideas into prototypes by the end of the event*. As stated on the home page of its website, Museomix is a "three-day creative sprint in a museum" (our translation, www.technoculture.club/projets/Museomix, 2016-01-22). During the first half-day, participants were supposed to propose ideas and form teams around some of them. They then had two days to turn these ideas into some sort of digital-based prototypes. The remaining half-day was left for the visitors of the museum to come and test the prototypes. This basic program had been communicated to the participants *through* Museomix's website, the participants' handbook, and the introductory speeches the organizers gave at the beginning of the day. It was also reflected in one of the spaces available to the participants, the "techno room", which was packed with

various technologies (e.g. laser-cutting machine, 3-D printer, touch screen, programming tools, etc.) that the participants were invited to use to build their prototypes.

6.2 Requirements Specific to the Pitches

The first two requirements that were specific to the pitches derived from the specifications of Museomix's team formation process. These specifications were detailed by the Museomix master of ceremonies at the beginning of the event and can be summarized as follows: there are seventy-two participants. Each participant falls into one of the seven following "profiles": "content expert", "communicator", "maker", "graphic designer", "user interaction expert", "[software] developer", and "improbable". Participants must form teams that include six members and at least five of these "profiles".

Note that the distribution of participants in teams is inseparable from the idea selection process, which took place in four steps: first, participants had to individually write down ideas on post-it notes that they stuck on large panels (each panel being dedicated to one "grand challenge"). Second, they were invited to talk to one another about the one idea they happened to like the most. If all went well, participants then started forming "team nuclei" around certain ideas. Third, each "team nucleus" pitched its idea in front of all the participants and mentioned the "profiles" they needed to complete their team. Fourth, participants had twenty minutes to negotiate and form teams that met the team formation criteria.

This elaborated team formation process had two consequences for the pitches: (a) When they pitched their ideas, teams were likely to be incomplete. A requirement of the pitch thus was to *state the profiles that a team needed to be complete*. (b) It was also likely that there would be more pitches than ideas that could be developed (as it turned out to be, twenty-two ideas were pitched and only twelve were developed). Another requirement of the pitch was thus to *present an idea that was appealing enough to attract the participants that a team needed in order to be complete (and retain the ones it already had)*.

In addition to these, five other requirements more narrowly concerned the logistics of the pitches. Museomix's master of ceremonies introduced these last requirements a few minutes before the beginning of the pitches. As she explained, the teams that wanted to pitch their idea had to:

- Form a line on one side of the stage in the "plenary room",
- Step onto the stage when the master of ceremonies called them,
- Have a maximum of two speakers per team,
- Present their idea in no more than 45 s,
- State the name of their team.

As shown in this analysis, to some extent, participants' ideas started to exist way before any participant expressed any idea. They materialized in (i.e. flowed or passed through) not only a series of requirements (some of them related to Museomix as a whole, others related to the pitches), but also the various beings that materialized (i.e. expressed) these requirements, namely: the participants' handbook, Museomix's website, speeches from the organizers (including a master of ceremony), wooden signs, the team formation process, the "techno-room", a set of technologies, large panels, post-its, a stage, etc. All

these elements materialized properties ("having creative ideas", "making them appealing", "turning them into prototypes", "stating the profile that one needs", etc.) that the participants were invited to relate to one another during their pitches.

Of course, this does not mean that the participants were devoid of any agency. As we shall see now, relating properties to one's idea, especially if one aims to do this convincingly, takes a lot more than saying, for instance, "our idea is creative and appealing, we can turn it into a prototype, and we just need a developer". The art of relating predefined properties to ones' idea lies precisely in the various beings that one introduces between the predefined properties and ones' idea. This is what makes the idea hold together (that is, to materialize as an identifiable idea) and what makes it one's own.

7 The Pitch of the "Secret Social Life of Artworks"

It is 12:48 am on the first day of Museomix. One after another, twelve "team nuclei" have pitched their ideas. None of them, however, seemed to have sparked much enthusiasm among the audience (us included). People occasionally laughed at a joke made by one of the speakers, but most of the time they merely applauded at the end of the pitch. This is about to change.

1		((Eva, Pierre and Bruno step onto the stage. Eva grabs the microphone.))
2	Eva	Hi
3		(1.0)
4	Eva	Just before, when you were in the tour through the Museum, did you
5		notice the monkeys?
6		(0.3)
7	Audience	um::: ((approvingly))
8	Eva	((nodding)) The funny sculpture. And did you happen to notice that the
9		painting, just behind, of the woman (.) it was like the portrait of a
10		woman and she kind of has her face averted like this ((imitating the
11		woman by turning her face)) as she was kind of like (.) tired of having to
12		look at the monkeys all [day long
13	Audience	[((laughs))
14	Eva	((nods and smiles)) So we want to kind of like give those portraits and
15		the artworks a <u>voice</u>. Kind of like (.) [lay open, reveal
16	Someone	[Oh:: ((admiring))
17	Eva	kind of the relationships that they have to establish just by hanging out
18		all day long=
19	Audience	=((laughs))=
20	Eva	=It's like- ((looking at the wooden sign where the name of the project is
21		written)) The project is called ((Pierre lifts up the sign to show it to the
22		audience. See Figure 2 below)) "The secret life- The secret <u>social</u> life of
23		artworks"
24	Audience	Ohhh ahhh ((appreciating, laughing and clapping))

25		((Eva gives the microphone to Pierre))
26		[((The camera lingers on the sign (5.0). It is divided in four parts by four
27		titles printed in black. Under each title some text is handwritten in
28		pink. Under "**title**" is written: "the secret social life of artworks".
29		Under "**description**" is written: "performance", "after-hours",
30		"spotlights", "conversation", "gossip", "(social) networks", and
31		"personalities". Under "**challenge**" is written: "renewing the
32		visitor's experience". The text written under "**team**" is not readable.
33		See also Figure 2 below))
34	Pierre	[((From this point on, the interaction is in French)) Um yes so "the
35		secret life of artworks" uh:: in French. And we would like to lay open a
36		little this secret life that is happening, these secret exchanges that may
37		happen between a painting, a sculpture, a sculpture that is outside, and
38		so on (.) try to lay open this a little. Uh::
39	Élodie	Which profiles do you need? [°to complete°
40	Pierre	[At the moment we have a developer, me I
41		am more in UX, [user] experience, and Bruno who is a graphic designer.
42		We are looking for someone in communication and mostly in content,
43		very much, I think we are going to need it ((Bruno nods yes)) and
44		making too (.) makers of all stripes, join us ((Bruno nods yes, smiling))
45		and we're also looking for someone who is not necessarily a participant
46		but someone from the museum who could give- make references, well
47		[who has knowledge of the content
48	Élodie	[This, they're going to go around, yes. No need to put it in your team,
49		it's all right. Thank you
50	Pierre	[Thank you
51	Élodie	[Great ((she starts clapping while Eva, Pierre and Bruno step down from
52		the stage))
53	Audience	((Clapping))

This excerpt can also be found here: https://youtu.be/GHmj0Zsqq-g.

At the beginning of this excerpt (l. 1–3), we see Eva, Pierre, and Bruno following the requirements that regulate the beginning of every pitch (during Museomix). When Élodie calls them, the three of them step onto the stage, Eva grabs the microphone to greet the audience. By doing this, they implicitly signal three things: (a) that they have an idea, (b) that they are about to present it, (c) that Eva will do the presentation. In other words, we could say that the idea – even if it has not been publicly expressed yet – has already materialized through three properties here: *a team*, *a spokesperson*, and *a near future*.

Eva then asks the audience a question – "Just before, when you were in the tour through the Museum, did you notice the monkeys?" (l. 4–5), to which the audience responds with an approving "um:::" (l. 7). Two comments can be made about this first exchange. First, while asking the audience if they noticed the monkeys, Eva says very little to identify them. She only says that they could have been noticed "during the tour through the museum" before calling them "the funny sculpture" (l. 8)), which is a way to stage their noticeable character as speaking for itself. Thus, when the audience confirms, through an approving murmur, that they did notice the monkeys, they also confirm their noticeable character, which somehow materializes itself in their reactions (the readers can judge for themselves by looking at Fig. 1 below).

Fig. 1. "The monkeys" Eva refers to in her pitch, also known as "Old Enemy, New Victim" by Tony Matelli

Second, a basic requirement of the pitch script is, as we know, to present an "idea", in the sense of "a thought, plan, or suggestion about what to do" (Merriam-Webster online dictionary). The audience is thus invited to search for a connection between the monkeys' noticeable character and a "plan" or "project". Yet, there is nothing in what Eva says at this point that allows them to make this connection. There is thus a suspenseful or intriguing quality that becomes attached to the monkeys' noticeability. The audience is led to wonder: "what on earth is Eva trying to tell us with the monkeys?"

In short, at this point, the idea, which is about to be presented by Eva on behalf of her team, materializes through a new set of properties, namely *the intriguing character of the monkeys' obvious and audience-confirmed noticeability*.

Eva then asks the audience another question: "did you happen to notice that the painting, just behind, of the woman (.) it was like the portrait of a woman and she kind of has her face averted like this ((imitating the woman by turning her face)) as she was kind of like (.) tired of having to look at the monkeys all day long" (l. 8–12). The audience responds by laughing (l. 13). Four comments can be made about this part of the excerpt.

First, while presenting the woman as being tired of having to look at the monkeys, Eva carefully points out the elements that make this feeling plausible: (a) the painting of the woman is located "just behind" the monkeys (l. 9), (b) they are together "all day long" (l. 11–12), and (c) the woman has "her face averted" (l. 10). The presentation of these elements also changes the meaning of the monkeys' noticeable character, which now appears as a key element of the woman's feeling of weariness. Second, Eva discreetly indicates that the woman's weariness also has a fleeting nature. She asks the audience if they "*happen[ed]* to notice" the elements that support (or materialize) it (l. 8), thus suggesting that they may very well have not. She also presents these elements as being

approximations ("[the woman] *kind of* has her face averted", l. 9–10) or hypotheses ("*as she was* … tired", l. 11).

Third, while the woman's weariness (and everything that makes it plausible) certainly changes the meaning of the monkeys' noticeability, it still does not allow the audience to make a connection with an "idea" in the sense of a project or plan for action. In this respect, it only adds substance to the intriguing nature of what Eva is saying. Fourth, the audience's reaction (laughing) shows that the relation that Eva has established between the woman and the monkeys is funny, or at least funny enough to trigger these laughs. Thus, we could note that, at this point, the "idea" appears to materialize through the following properties (besides Eva and the team): *the intriguing, funny, and fleeting nature of everything that makes the woman being tired of having to look at the monkeys plausible*.

Eva then states: "So we want to kind of like give those portraits and the artworks a voice. Kind of like (.) lay open, reveal kind of the relationships that they have to establish just by hanging out all day long" (l. 14–18). The audience responds again by laughing (l. 19) while someone lets out an "oh::" of admiration (l. 16). Four comments can be made about this exchange.

First, Eva finally shows how the fact that the woman is tired of having to look at the monkeys can be connected to a project: (a) the woman's wariness is an example of "the relationships" that "those portraits and the artworks" (i.e. those of any museum) "have to establish just by hanging out all day long" (l. 14–18); (b) what Eva's team "want[s] to" do (l. 14) (i.e. their project) is to "give … [these] artworks a voice" (l. 14–15) and "reveal [their] relationships" (l. 15–17). Of note, this connection dissolves the intriguing property that had built up so far. Second, the acts of "giv[ing] … the artworks a voice" (l. 14–15) and "reveal[ing] their relationships" (l. 15–17) mark (or materialize) the transformative or creative nature of the project. Thanks to this project, what has been voiceless and hiding until now will be made audible and visible to everyone; what has been fleeting will become more enduring.

Third, the admiring "oh" that someone lets out in the audience (l. 16) marks (or materializes) the admirable nature of the project. This new property (being admirable) may be fragile in the sense that only one person seems to recognize it at this point, but it is clearly audible. Fourth, by laughing (l. 19), the audience materializes the funny nature of the project. So, at this point the idea *presented by Eva on behalf of her team* materializes through the following properties: *it is the creative, funny, and somewhat admirable character of a project that is illustrated by the intriguing and fleeting nature of everything that makes the woman being tired of having to look at the monkeys plausible*.

Eva then adds: "It's like- ((looking at the wooden sign where the name of the project is written)) the project is called ((Pierre lifts up the sign to show it to the audience)) 'The secret life- The secret social life of artworks'" (l. 22–23). The audience responds by letting out admiring "ohhh" and "ahhh" and by laughing and clapping (l. 23). Five comments can be made about this exchange.

First, the project – and therefore the idea itself – now has a name. Second, this name echoes with several elements already presented by Eva. It recalls (i.e. expresses or materializes again) (a) that artworks develop relationships of their own (they have a "social life" (l. 22)); (b) that these relationships are easily missed by the visitors (they

are "secret" (l. 22)); and (c) that the team's job is to make these relationships clearly audible and visible to the visitors. In other words, it is evocative of the plausible and fleeting nature of the relationships the project seeks to capture, and of the creative nature of the project itself.

Third, having the project name written on a wooden sign makes it more enduring or perennial. It amounts to delegating to the enduring qualities of the wooden sign the task of continuing to remind the participants of the plausible and fleeting nature of the relationships between the artworks and of the creative nature of the project. Fourth, the admiring "ohhh" and "ahhh" as well as the clapping and laughing (l. 23) that come from everywhere in the audience at this point clearly confirm the admirable and funny character of the project. Fifth, to the extent that no other pitch has triggered such enthusiastic reaction in the audience before (and none will after), the audience's reaction at this point also marks the greater popularity of this project.

At this point, the idea *presented by Eva on behalf of her team* is made of such an intricate web of properties that it becomes difficult to summarize them. We could venture to say that it is made of (i.e. materialized through) *the creative, admirable, funny, and popular character of a project that has an evocative and enduring title, and that is illustrated by the intriguing, fleeting, and plausible nature of the relationship between the woman and the monkeys*.

The camera then lingers on the sign held by Pierre (l. 26–32, see also Fig. 2 below), which allows us to discover the other elements that are written there (that is, beside the project title). Several comments can be made about these elements.

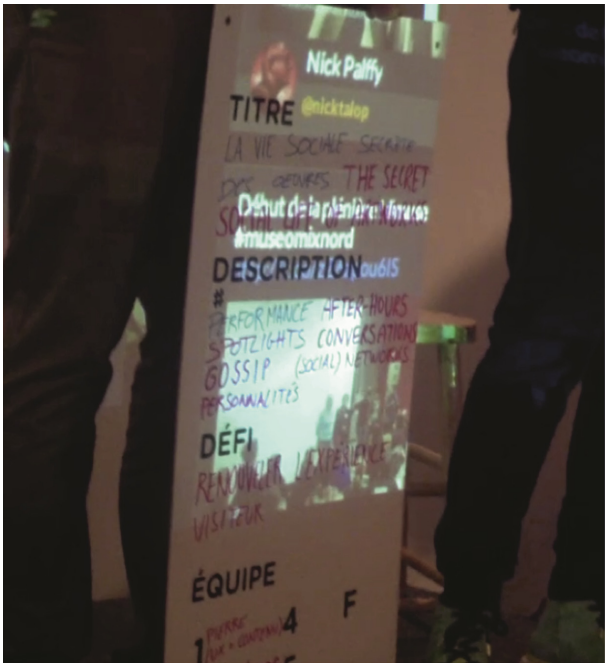

Fig. 2. Wooden sign held by Pierre during the pitch of the Secret Social Life of Artworks

First, seven keywords are written under the label "description": "performance", "after-hours", "spotlights", "conversation", "gossip", "(social) networks", and "personalities". While it is difficult to know how exactly they relate to the project Eva just described, they seem to complement it by offering some leads as to how the project could be implemented. "Spotlights", for instance, seem to refer to technologies that could be used to render the artworks' relationships visible. In this respect, these keywords manifest (or materialize) the team's concern for the prototype they are supposed to build during the next two days.

Second, "renewing the visitor's experience" is written in the "challenge" section, which shows that the team has chosen to address this particular challenge among the six "grand challenges" proposed by Museomix (see above). Third, having the project "description" and the "challenge" it addresses written on a wooden sign makes them more enduring (that is, they materialize through more enduring beings). It allows them to keep "speaking" when no human (directly) speaks on their behalf, which is precisely what we see in the present situation.

These elements (i.e. *the enduring quality of the team's concern for their prototype and their challenge*) add to the web of properties through which the team's idea materializes.

Pierre then translates the project's title and objective in French (l. 33–37), which gives the team's idea yet another property – that of *being partly expressed in French.*

Élodie then asks Pierre: "which profiles do you need?" (l. 38). Pierre answers by telling those they already have ("a developer" (l. 39), someone in "[User] Experience", and a "graphic designer" (l. 39–40)) and then those they are looking for ("someone in communication [and] content" (l. 41), "makers" (l. 42), and "someone … from the museum" (l. 44)). Two comments can be made about this exchange.

First, we must recall that an idea is allowed to be developed in Museomix only if it is supported by a six-person team that includes at least five of the "profiles" specified by the organizers (see above). So, by telling which profiles they already have and those they are looking for, Pierre not only shows that their *team* is three members and two profiles away from being allowed to continue in Museomix – this is true for their *idea* too.

Second, while presenting the profiles they need, Pierre insists on one particular competence – "content". He says: "We are looking for someone in communication and mostly in content, very much, I think we are going to need it" (l. 40–43). This concern for "content" even leads him to free himself from the profile requirements and ask for "someone who is not necessarily a participant, but someone from the museum who … has knowledge of the content" (l. 44–45). This insistence on "content" seems to be related to the fact that the project heavily relies on "the relationships that [artworks] establish just by hanging out all day long" (l. 17–18), which is part of the "content" of the museum. In other words, to some extent, it is the team's idea itself (i.e. its reliance on artworks' relationships) that dictates that they look for this particular competence.

Let us try to summarize the idea *presented by Eva on behalf of her team* one last time. This idea now materializes through *the creative, funny, admirable, and popular character of a project that has an evocative and enduring title, an enduring preoccupation for a prototype and a challenge, that is partly translated in French, that is two*

profiles away from being allowed to continue in Museomix, that dictates a particular preoccupation for content, and that is illustrated by the intriguing, fleeting, and plausible nature of the relationship between the woman and the monkeys.

Finally, Élodie thanks Eva, Pierre, and Bruno (l. 47), Pierre thanks her back (l. 48), and the team steps down from the stage (l. 49–50) while the audience is clapping (l. 51). This last sequence of actions amounts to disconnecting the team's idea from the pitch situation, and therefore also from the means we had to follow it (at this point).

To conclude this analysis, it is noteworthy that the idea presented by Eva relates to many of the requirements we identified above. As we saw, this idea materializes notably through the following properties: it is presented by one spokesperson, speaking on stage, after being called by the master of ceremonies. It also appears to be not only creative but also admirable and popular (in other words, appealing). It shows a preoccupation for the prototype the team is supposed to build, for one of the challenges it is supposed to address ("renewing the visitor's experience"), as well as for the profiles it is supposed to include.

However, this idea also materializes (i.e. flows) through many other beings. First, it materializes through other properties: it is funny and intriguing, it has an evocative and enduring title, it is partly translated in French, it dictates a particular preoccupation for content, and it is illustrated by the fleeting and plausible nature of the relationship between the woman and the monkeys. In other words, all the properties we encountered in our analysis, whether they had been predefined by the organizers or not, contribute to giving substance to the idea presented by Eva.

Second, and perhaps more importantly, each of these properties materializes through specific configurations of beings. Consider for instance *the fleeting nature* of the relationship between the woman and the monkeys (a relationship that is supposed to illustrate the team's idea). This property cannot be said to inherently belong to the relationship between the woman and the monkeys, nor to the words that form the question "did you happen to notice…?", nor to the person who is asking it (Eva). However, when Eva asks this particular question about this particular relationship, the property "being fleeting" materializes. That is, it becomes a property of the relationship when Eva presents it as what relates the relationship, the words that forms the question she is asking, and the fact that she is asking it.

Therefore, the idea presented during this pitch does not materialize (i.e. flow) only through the properties that we highlighted in our analysis, but also through all the beings (words, gestures, intonations, artifacts, people) that materialize these properties when they happen to relate to one another in a certain way.

8 Discussion

So what can be learned from this analysis and to what extent does it allow us to go beyond the notions of entanglements and imbrications? First, we can note that at no point in our analyses did we have to choose between what belonged to the so-called material world and what belonged to the so-called social world. On the contrary, following the evolution of an idea consisted in identifying the various ways by which it

materialized itself, whether (a) *through* the requirements about what this idea had to look like, requirements that precede the pitch itself or (b) *through* how this idea was presented to the audience when Eva and Pierre pitched it. In other words, we clearly saw that for an idea to exist, it has, by definition, to materialize itself through various beings that *anticipated* or *embodied* it.

Something as abstract as an idea can thus take multiple forms, which we first identified through the requirements that the organizers of Museomix communicated to the participants. These requirements specified what an idea had to look like, no matter what it came to be at the end, that is, they stipulated how it had to materialize itself; the *properties/relations* this idea had to establish in order to be selectable: (a) to be creative, (b) to reinvent museums, (c) to be translatable into prototypes by the end of the event, (d) to be defended by a team nucleus, and (e) to attract enough participants for its team to be complete. Although ideas had not been concretely and explicitly formulated yet, we saw that they had been materially anticipated by the Museomix device, whether through their website, the participants' handbook, or the instructions given by the organizers over the course of the event. In other words, even if they had not been defined yet, ideas started to materialize themselves through the discussions, discourses, and apparatuses that determined what properties they had to have.

While ideas and their expected properties had therefore been anticipated, we saw that the pitches themselves were the opportunity to present these ideas concretely, expecting that they would precisely meet the requirements that had been defined, presented, or discussed before. Our analysis allowed us to show how Eva cleverly crafted her speech to demonstrate that her team's idea indeed met or spoke to these requirements. How did she do that? Precisely by both presenting and reconstructing the properties of an idea that progressively *materialized* itself in front of her audience through the relations she established and revealed.

This idea, which, as we saw, had already been anticipated by the Museomix device, was able to acquire the following properties or characteristics: (a) intriguing, (b) creative, funny, and somewhat admirable, (c) illustrated (through the relationship, fictively reconstructed by Eva, between the "monkeys sculpture" and the "woman in the portrait"), (d) titled ("The Secret Social Life of Artworks"), (e) defined and summarized ("unveiling the (fictive) nature of the relationships between the museum artworks"). Each time, we saw that the properties/qualities/aspects/dimensions of this idea *materialized themselves* through something she said or embodied, but also through the beings she was staging in her talk: the monkeys sculpture, the woman in the portrait, the title she unveiled and presented through the wooden sign, etc.

In keeping with our ontological positioning, we see that we do not need to speak in terms of entanglement or imbrication between two separate worlds: the world of materiality and the world of sociality. What we have is, on the contrary, *one* (plural) world that *always already* presents itself through its material and social dimensions/aspects/properties/qualities, that is, *through its embodiments, which are always made of relations*. We thus have a way to distinguish (ontologically and analytically) what we mean by social (the fact that something or someone is made of relations) and material (the fact that something or someone is made of other things), even if these aspects always appear together, but we also have a way to show that this distinction does not imply a separation

between two worlds. Relationality and materiality should almost be seen – if we were to venture a metaphor, which always has its limitations – as the two faces of the same coin.

What we also hope we were able to show is that this analysis allows us to not only illustrate an epistemological/ontological argument, but also to teach something crucial about the relational/material dimensions of ideas. In other words, it says something about what could be called the *communicative constitution* of things we call ideas. Far from being reduced to the question of organizational ontology, we therefore see that the CCO perspective allows us to illustrate what communication scholars can say about topics that have been, until now, mainly reserved for psychologists and philosophers.

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Enactment or Performance? A Non-dualist Reading of Goffman

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Abstract. This paper contributes to the sociomateriality research orientation with a critical examination of two concepts – enactment and performance – that have been associated with the notion of performativity. While a preference for the term enactment has been expressed in influential IS literature, we argue that sociomateriality will benefit from an engagement with the body of research that focuses on Goffman's notion of performance. We provide a critique of Mol's reading of Goffman's notions of "persona" and "mask". We then show how a careful non-dualist reading of his work reveals his opus as relevant and useful for sociomateriality, because his notion of performance affords locating technology in differing roles within a performance. In doing so, we argue that Goffman's work, largely overlooked within this stream of research so far, contributes important concepts and terminology for making sociomateriality actionable for IS.

Keywords: Sociomateriality · performativity · theorizing · information systems (IS) · performance · Goffman · enactment · hermeneutic reading

1 Introduction

Sociomateriality has predominantly been grounded in a performative, non-dualist ontology [1–5]. Such an ontology holds that reality does not exist independently of action but rather is brought into being and sustained through material-discursive practices [6, 7]. This understanding challenges our often taken-for-granted dualist understanding, which holds that reality is "objective and out there", existing independently of the models by which we know and represent it (in the mind) [8]. While performativity is often mentioned in sociomateriality research [1, 5, 9], the vocabularies and histories involved in this approach are sometimes slippery and present us with particular choices and challenges.

In this paper we examine two terms that are associated with performativity: enactment and performance. We locate in the performativity literature a suspicion against the term performance and a preference for the term enactment [1, 10]. Intrigued by this preference we conduct a critical hermeneutic reading of this discussion. Our analysis reveals that the preference for the term enactment may inadvertently conceal a body of literature on performance that is of relevance to sociomaterial theorizing: the work of sociologist Erving Goffman [11].

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Consequently, we come to reconsider the relationship between the two terms. We argue that while boundaries, materialities and agencies are enacted, these can productively be understood as effects of sociomaterial *performance*. We thus demonstrate that a sociomaterial reading of Goffman's notion of performance holds potential for enriching sociomateriality research.

2 Performativity in Sociomateriality Research in IS

According to Orlikowski and Scott [1], performativity is a central concept for sociomateriality because this worldview aligns with an interest in how boundaries and relations are actively brought into being rather than existing a priori and universally:

> For scholars of sociomateriality, the notion of performativity draws attention to how relations and boundaries between humans and technologies are not pre-given or fixed, but *enacted* in practice. ([1], p. 462, our emphasis)

This view challenges an understanding of the world as being already furnished with entities having inherent boundaries and properties that define what they are. Instead, in a performative understanding, entities are what they are through their relations; they come to be recognized *as* objects, with clear boundaries and properties, only in and through "practice" [1].

The term "enacted" is used to describe how such boundaries and relations are brought into being. *Enactment* is further positioned as the preferred way of understanding how reality is produced in sociomateriality research, in contrast to the notion of *performance*:

> A central idea entailed in sociomateriality is the notion of *performativity* (Barad, 2003). While related to the notion of performance, performativity is not synonymous with it. Where "performance" refers to the doing of some activity (as when a physician "performs" a medical examination, or a musician "performs" in front of an audience), performativity refers to enactment. [1] (p. 460)

It is clear from this account that "performance" is being associated merely with the "doing" of an "activity" and thus demoted in favour of "enactment" [1].

Intrigued by this distinction, we conducted a hermeneutic reading of the wider body of sociomateriality literature and found more evidence of an explicit preference for the term enactment. Barad [12] and Suchman [2] for example both theorized that boundaries, materialities, and even agencies are effects that are "enacted". Suchman specifically uses the word enactment in response to the linguistic challenges of talking about material agency and the fluid boundary that arises between human and machine in action:

> The problem is less that we attribute agency to computational artifacts than that our language for talking about agency, whether for persons or artifacts, presupposes a field of discrete, self-standing entities. As an alternative, we can take the interface not as an a-priori or self-evident boundary between bodies and machines but as a relation enacted in particular settings and one, moreover, that shifts over time. [2] (p. 263)

What is "enacted" here is a particular kind of phenomenon – an interface or boundary – and the term enactment captures well the relational, situated and temporal way in which boundaries are brought into being. Enactment is thus a useful term for side-stepping some of the more intentional connotations of performance, and lets us talk about the significant issue of how boundaries come into being and therefore how objects are stabilized in practice.

However, in the spirit of advancing the sociomateriality research agenda we consider how a re-reading of the concept of performance, from a relational, non-dualist perspective, might assist researchers in their empirical and conceptual development of sociomaterial understandings of everyday life. We recognize that an emphasis on the emergence and stabilization of boundaries is important to a sociomateriality research agenda. What is less clear, however, is how we are to study these processes of "materialization" [6].

There has, for instance, been some agreement that from a sociomaterial perspective, things, people, and practices are entangled [13, 14]. The ontological inseparability implied in this word is indeed a necessary starting point for challenging the dominant dualist position in IS. There is, however, a risk that we are left without vocabularies to talk about how what we here term *collectives* – of things, people and practices – come to cooperate in the sociomaterial production of reality. We recognize that one challenge that researchers face in investigating sociomaterial phenomena is in accessing the kinds of activities [7] that work to produce effects, such as interfaces and boundaries between entities. Another challenge lies in how to talk about the role of humans and non-humans in bringing about this ongoing activity, which from a performative understanding works to stabilize certain realities and marginalize others [3].

We suggest as a possibility here that the word performance, if treated carefully, offers a less recognized and potentially rich path for talking about empirical inseparability and its active, processual character. In the following hermeneutic reading, we put forward an argument where the concept of performance opens up a body of literature to researchers who are interested in sociomateriality that may otherwise be considered off limits, because of the extant literature's dismissal of the concept in preference of enactment.

We will show that performance has a rich history in feminist, sociological and existentialist literature, and demonstrate that in our readings of key texts, the concept of performance is not necessarily tied to the notion of an intentional, individualistic exercise of choice or whim. It is thus possible to divorce the notion of performance from a dualist preoccupation, which has traditionally either overstated the role of human agency or reduced all action to subjective experience.

We demonstrate an alternative reading, where the term performance is understood as a complex, collective activity that gives rise to "effects" [2, 11] that can be understood in performative terms as working to sustain certain realities and marginalize others. We draw on and interpret Goffman's dramaturgical framework to bring forward literature on performance that may otherwise be viewed as sitting outside of our emerging research tradition. Finally, we offer examples illustrating how such a reinterpretation of Goffman could inform the study of emerging IS phenomena.

3 Methodology: A Hermeneutic Reading

To understand how the notion of performance relates to performativity, and furthermore how it may align with sociomaterial IS research, we read back over key texts in an iterative manner [15]. We have followed a "reference trail" in looking backwards in time to read into how these conversations emerged between authors referring to each other's texts [15]. This hermeneutic process informs our critical reading of texts that have been in conversation with one another. We interpret them afresh, for an IS readership interested in sociomateriality research, as we read one text through another [16].

Hermeneutics holds that understanding is an ongoing process of interpretation and re-interpretation where a final understanding is neither sought nor possible [15]. Nevertheless, using a hermeneutic approach, a reader can compare interpretations and come to a different understanding of how a text and its ideas relate to contemporary conversations. Consequently, by conducting a hermeneutic reading we do not seek to unpack the *true* meaning of a particular text or quote. Following our sociomaterial orientation we do not hold that meanings are fixed universally but that they come into being through engagement with the text in a particular way and at a particular moment in time. Specifically, we argue that any text is always read on a particular prior understanding, in a certain context, and is therefore never value-free but rather historically charged.

In the following we will demonstrate the grip that the dominant, dualist understanding [17] of the world exerts in readings of texts and that an awareness of this influence can be productive, and is indeed necessary for the advancement of the socio - materiality project. While we do not want to imply that we can fully step outside and avoid this influence we argue that it is important for scholars of sociomateriality to be aware of the ways in which historical texts might have been read previously by others and consequently how they can be read differently when assuming a different stance. We thus seek to show where a sociomaterial background allows interpreting texts in a new way that will provoke further discussion and debate.

4 Mol's Objections to Goffman's "Performance"

In this section we outline our hermeneutic reading of a conversation that we have located in texts by Mol [10] and Goffman [11] and other authors that Goffman draws upon. In our reading of Mol [10] we locate an explicit dismissal of the term *performance*. We iterate between texts to explore the charges brought against the concept and to suggest an alternative reading.

In Mol's 2002 text *The Body Multiple*, we find a potential source of the strong distinction being made between performance and enactment, and an explicit argument against the noun "performance", and in favour of the verb "enact":

> In the literature there has been a lot of discussion about the term performance – a term that does not only resonate the stage but also success after difficult work and the practical effects of words being spoken. I do not want these resonances, nor do I want this text to be burdened with discussions that it seeks no part in […] It may be helpful to avoid the buzzword. To look for another term. A word that is still relatively innocent, one that resonates with fewer agendas. I have found one. And, even if I have been using the term performance elsewhere in the past, I

> have carefully banned it from the present text. I use another verb instead, enact, for which I give no references, precisely because I would like you to read it in as fresh a way as possible. In practice, objects are *enacted*. [10] (p. 38–41, our emphasis)

Mol goes on to give two reasons for her choice. Firstly, she is critical of Goffman's dramaturgical analysis of performance in everyday life, attributing to him the notion that "adults have real selves deep down, backstage" in which case the "identity people perform is not deep, it is a *mere* performance" [10] (our emphasis). Mol's second criticism is of Judith Butler's theorization of gender as performed [6]. In both of these critiques, the main source of concern is the idea of performance being a "mere" putting on of a "mask" or external identity: an isolated act by a willful agent that is not contingent on physical realities [10].

In the following, we investigate Mol's objection further by looking closely at what she refers to as Goffman's "outdated text" [10], to see what we can learn about performance and what of the concept can be salvaged for sociomaterial theorizing.[1] We begin by looking more closely at Mol's critique of Goffman, before we go to Goffman's text, *The Presentation of Self in Everyday Life* [11]. We come to appreciate that while Goffman's text is indeed in some ways "outdated" (for example, in his discussions of race and gender), his concept of "performance" is, when read in a particular way, not only compatible with a performative worldview but also adds important new distinctions to the sociomateriality project.

5 A Non-dualist Re-reading of Mol's Critique of "Self" in Goffman

Given that *The Body Multiple: Ontology in Medical Practice* [10] is an influential text for many sociomateriality researchers (ourselves included), Mol's banning of the word "performance" in 2002 in favour of "enact" carries significance. This led us to investigate her reasoning further.

5.1 Mol's Critique of the Performed Self

Mol [10] characterizes Goffman's 1959 text as concerned with a distinction between the *real* versus *performed* selves that are presented in everyday life. According to Mol's critique, Goffman puts forward an account of human identity where a *real self* exists a priori and universally, but this real self is concealed in the presence of others through "performance". Mol [10] describes Goffman's work as follows:

> In 1959, Goffman borrowed the language of the theatre in order to talk about human subjects. When people present themselves to each other, Goffman said, they present not so much themselves but a self, a persona, a mask. They act as if they were on a stage. They perform … adults have real selves deep down, back stage … The identity people perform is not deep, it is a mere performance. [10] (p. 36)

[1] While Butler's work on gender performance is also important to this debate, particularly the introductory section of her 1993 book *Bodies that Matter* [6], in the interest of focus we emphasise here Mol's critique of Goffman's 1959 text [11].

In this critique, performance is associated with the concepts of "persona" and "mask", which are supposedly "less real". In other words, whatever a person performs "as if they were on a stage" is only a surface impression, while a "real" self is hidden "deep down, back stage". Such a reading of Goffman would indeed make him incompatible with a performative world view, because it implies a dualist understanding of the world as split into a persistent "real" world that is covered over by a kind of subjective, intentional, arbitrary surface – a "mask" that is taken on and discarded at will by "human subjects".

In the following we will challenge this reading of Goffman's work. In particular, we will demonstrate that such a reading already assumes a dualist position a priori, and that when taken on a non-dualist background his work is revealed very differently. For doing so we go to his text, to see what Goffman [11] has to say firstly about personas and masks, and then more fundamentally what he has to say about the topic of "reality" itself.

5.2 Personas and Masks in Goffman

We find that Goffman explores the concepts of persona and mask in his book mainly through reference to other authors. We will thus provide three quotes by way of example and demonstrate in each instance that dualist and non-dualist readings draw very different boundaries, highlight different parts and thus lead to very different interpretations. In a second step we show that Goffman utilizes the notion of performance to develop a *non-dualist* reading that, we argue, has not only been marginalized in sociomaterial theorizing so far, but offers useful distinctions and concepts to IS scholars.

Firstly, Goffman [11] quotes a text by Park [18] to show that the etymology of the word "person" is strongly linked to the word "mask". In contrast to Mol's reading, a mask is considered here as preceding the organic being inhabiting it:

> It is probably no mere historical accident that the word person, in its first meaning, is a mask. It is rather a recognition of the fact that everyone is always and everywhere, more or less consciously, playing a role … It is in these roles that we know each other; it is in these roles that we know ourselves … In a sense, and in so far as this mask represents the conception we have formed of ourselves – the role we are striving to live up to – *this mask is our truer self*, the self we would like to be. In the end, our conception of our role becomes second nature and an integral part of our personality. *We come into the world as individuals, achieve character, and become persons*. [18] (pp. 249–250, in [11] p. 30)

When read on a dualist background the focus is likely to be on the distinction between person and role, evident in statements such as "everyone is […] playing a role", which might lead to the conclusion that "role" or "mask" conceal what is otherwise the *real person*. However, when we take the text on a non-dualist background, what stands out is the way in which the "mask" is what we know each other as and what we become. Contrary to Mol's [10] interpretation, this fragment then becomes an argument for an understanding of identity as being i) relational and ii) an ongoing process. By pointing out that in a sense, "this mask is our truer self", a performative understanding of identity

can be assumed that is quite distinct from the dichotomized understanding of real self vs. fake (performed) self.

Secondly, Goffman [11] explores this issue further by quoting an older text by Durkheim [19], who explains that "personas" are masks that become a materialized constant, that distracts us from the precarity of organic existence:

> Everyone who is sure of his mind, or proud of his office, or anxious about his duty assumes a tragic mask. He deputes it to be himself and transfers to it almost all his vanity. While still alive and subject, like all existing things, to the undermining flux of his own substance, he has crystallized his soul into an idea … Our animal habits are transmuted by conscience into loyalties and duties and we become "persons" or masks. [19] (p. 272, in [11] p. 65)

In this fragment the contrast between a dualist and non-dualist reading becomes even more pronounced. On a dualist view what stands out is that everyone is "his own substance", but becomes "a tragic mask" in the process of engaging with the social world. Note that when one already presupposes the existence of a real self, the text merely reaffirms the split between real self and mask. Conversely, if we read the same text on a non-dualist pre-understanding, where we do not assume that one's self is fixed a priori, what stands out is how a "person" is always performed in ongoing socio-material practice of "holding office"; in other words, through participating in life. In this second reading, the fragment very much exhibits a performative understanding of reality, where reality is stabilized over time through iterative activity [7]. The notion of an idea being "crystallized" against a background of temporal organic flux is reminiscent of how, in sociomateriality research, boundaries and materialities are considered to be stabilized in practice as effects of activities and routines [5].

Goffman makes further reference to masks, this time in commenting on a text by existentialist feminist philosopher de Beauvoir [20]:

> Through social discipline … a mask of manner can be held in place from within … [but] we are helped in keeping this pose by clamps that are tightened directly on the body, some hidden, some showing. [11] (p. 65)

Again, on a dualist account, the focus will be on the mask that literally becomes something held before the body to conceal the self. Yet when taken on a non-dualist background what stands out is the reference to "social discipline" and the involuntary nature of masking, in that personas or masks are not only put on at will by a human subject as agent, rather they are "held in place from within" and from the pressures of being a part of a social practice. This account can thus be read as a sociomaterial treatment of how society and physicality (the mask, the body, clamps) are entangled in constructing identities and practices, where one entity does not have sole custody over reality. Rather, entities are entangled in practice and co-define one another, in a manner that is politically charged.

When read in this way, the above quote contains a further elaboration on the way in which things are involved in social performances, which are important for how we stabilize our identity in the world. Goffman supports this understanding by arguing that inhabiting a role requires us to engage in practices which are deemed appropriate by others – in other words, we do not merely and knowingly take on a role, as we would

put on a mask. Instead, we work at being known as our roles through performance, in a social process wherein our very identity is at stake:

> To be a given kind of person, then, is not merely to possess the required attributes, but also to sustain the standards of conduct and appearance that one's social grouping attaches thereto. The unthinking ease with which performers consistently carry off such standard-maintaining routines does not deny that a performance has occurred, merely that the participants have been aware of it. [11] (p. 81)

Central to this argument is firstly that a role is a collective *involvement*: it is active, even if the performer is not *aware* of their activity. Secondly, the framework from which the performance is derived and against which its success is judged sits outside of the individual performer. Consequently, we argue that, if we free ourselves from dualist ontological baggage, we are able to interpret this argumentation to mean that performances are always inherently at once active as well as both social and material, where one category informs and depends upon the other.

As a result, the routines and accessories that Goffman discusses as being part of performance are not mere frivolity and fancy, rather they are centrally involved in the work that is required for society to affirm, legitimize and bestow one's identity. We suggest that such a reading of performance moves well past the notion of a "mere" performance, involving the willful putting on and taking off of a surface-level mask as artifact. Rather, we come to interpret Goffman and those he cites as portraying performance as the collective work that goes into sustaining reality; the materialization of which we all in turn depend upon for our understanding for participating in practice.

6 A Non-dualist Re-reading of Goffman's Notions of Performance and Reality

Having challenged Mol's critique of Goffman's work through a hermeneutic re-reading, we will now take a closer look at Goffman's own statements about reality and performance. When taken on a non-dualist account, we find evidence that Goffman himself challenges a dualistic understanding of self and reality in subtle yet forceful ways. We argue that there are instances in the text that might be missed if one has already concluded that his talk about "masks" and "personas" must presuppose the existence of a "real self" and hence a dualist view of the subject matter. We have selected two key quotes that we believe demonstrate that Goffman [11] applies a more nuanced approach than has been portrayed.

6.1 The "Self" in Performance

The first relevant component of Goffman's 1959 thesis here is that he made a distinction between "performer" and "character". Importantly, Goffman does not attribute

either of these categories to the category of "real self". Instead, he shows how "the self" emerges in a relational sense between the two, in the process of performance:

> A correctly staged and performed scene leads the audience to impute a self to a performed character … The self, then, as a performed character, is not an organic thing that has a specific location, whose fundamental fate is to be born, to mature, and to die; it is a dramatic effect arising diffusely from a scene that is presented, and the characteristic issue, the crucial concern, is whether it will be credited or discredited. [11] (pp. 244–245)

This explanation of performance does not at all rely on a separation between real and surface self, rather, the self is the "dramatic effect" that arises diffusely from a scene in which a performer is involved in performance. The performer does their best to "correctly" stage and perform the scene, "in order to lead the audience to impute a self to a performed character". The audience can, however, as a collective, credit or discredit the scene that is being presented. The performer thus relies not only on their own work but also on their team mates and their audience in the process of *becoming* a self.

6.2 Performance and "Reality"

The "scene" that is performed by a collective is what Goffman [11] refers to as the "impression of reality" that is "fostered" or "sponsored" by the performing group. It is this fostered version of reality that is at stake in matters of performance before an audience. We note that it is also important to realize that a performer depends on many others (e.g. team mates, equipment, setting) in fostering a particular version of reality – the smallest betrayal could interrupt and discredit the scene and thereby the credibility of the performer's character. Paying attention to the role of the audience in performance is thus crucial to understanding why performance is never entirely in the hands of the performer, or even in the collective efforts of the performing team.

In the following quote, Goffman addresses how such a conceptualization of a collectively fostered impression of reality relates to a conventional scholarly pre-occupation with locating the *real* "reality"; in other words, Goffman here gives us an explicit account of his position on the matters discussed above:

> While we could retain the common-sense notion that fostered appearances can be discredited by a discrepant reality, there is often no reason for claiming that the facts discrepant with the fostered impression are any more the *real reality* than is the fostered reality they embarrass. A cynical view of everyday performances can be as one-sided as the one that is sponsored by the performer. For many sociological issues *it may not even be necessary to decide which is the more real*, the fostered impression or the one the performer attempts to prevent the audience from receiving. The crucial sociological consideration, for this report at least, is merely that impressions fostered in everyday performances are subject to disruption. [11] (pp. 43–44, our emphasis)

We see that Goffman directly addresses his position in conceptualizing "reality" by challenging the "common-sense notion" that there is a *real* "discrepant reality" behind the performance [11]. What he takes on here is nothing other than what we have so far referred to as the dualist position that always proceeds from the assumption of an a priori and universally existing essential reality. Conversely, he seems to argue that performance, far from being more or less "real", is all that we have access to:

performance is all there is. In contrast to the dualist understanding, Goffman demonstrates that there is no ground that is "real" as an objective yardstick against which performances can ultimately be judged. Rather, some ways of doing things become solidified as *the practice*, and these then act as a background against which other performances are judged as being appropriate or inappropriate.

Goffman [11] further suggests that rather than focus on "what reality really is", studies of performance should investigate the interesting question of how a particular version of reality becomes sustained at all and, in turn, what competing impressions of reality might unsettle it. In other words, certain boundaries that make up reality become the object of study, not the given ground from which to proceed, which is precisely the project of sociomateriality as we understand it:

> We will want to know what kind of impression of reality can shatter the fostered impression of reality, and what reality really is can be left to other students. We will want to ask, "What are the ways in which a given impression can be discredited?" and this is not quite the same as asking, "What are the ways in which the given impression is false?" [11] (p. 44)

In conclusion, we do not read Goffman's research agenda as claiming that "adults have real selves deep down, back stage" [10] (p. 36). Rather, we find that pursuing the question of what is "really real" is unproductive at best and a remnant of a particular common-sense, dualist grounding at worst. Instead, we find that Goffman [11] suggests that the ways in which social activities bring about and sustain realities, through what he calls *performance*, is worthy of attention. In drawing our efforts to the issue of how particular versions of reality are potentially threatened by other discrepant impressions, we are further prompted to consider the fragility of *local* realities; what is marginalized from them and what threatens them, as well as the ongoing collective work that goes into staging the performances that sustain what we take to be "real" in everyday life.

7 Re-interpreting Goffman for Sociomateriality Research in IS

In this section we first summarize the line of argument we have woven through our hermeneutic reading: that Goffman's notion of performance is compatible with a contemporary, performative sociomaterial perspective in IS. We then demonstrate what we believe a contemporary interpretation of Goffman's work on performance can *add* to sociomateriality research. Specifically, we adapt and interpret Goffman from a post-humanist perspective, and argue that it is possible and productive to consider how technologies play various roles in sociomaterial performance, for example as not only "prop" but as *setting*, *sign-equipment*, *team-mate*, *director*, or *audience*. We present this perspective not as a finished research tool but as a starting point for further discussion and debate as to whether and how Goffman and others' notions of performance can enrich sociomateriality research.

Before we consider what Goffman [11] may have to offer IS scholars with his conceptualization of performance, we first freely recognize that his text upon which we draw is not concerned with technology. It was written before many of the kinds of technologies we are interested in today existed. We acknowledge this fact but do not

deem that this precludes us from considering how we might adapt concepts from his work for a contemporary research agenda. We also note that previous adaptations of Goffman have already been made in IS studies that consider his better known theorizing of "back stage" and "front stage" regions [21–24].

7.1 Goffman and Inseparability

We have shown that Goffman [11] described "character" as an effect that arises from a scene of action. In his conceptualization, the performer is involved in the scene, but the character is a much more precarious category that depends on a successful staging of the performance. This staging involves the setting, props, team-mates, routines, and conventions, and, most importantly, a scrupulous audience that ascertains whether the performance "comes off". In this way, the performer owes much of their character – that is, their social role, as for example *lawyer* or *manager* – to a host of "others". Performance is in this conceptualization inherently *collective*. This is in keeping with a performative worldview which recognizes the interdependency of the work that goes into sustaining reality.

As a way of considering the world, sociomateriality emphasizes this inseparability of humans and technologies in practice [1]. The point of the concept of inseparability is that all entities rely on one another for their identities. This notion is well expressed in this excerpt from a study that Goffman [11] cites, about pharmacist practice:

> The store is, in a sense, a part of the pharmacist. Just as Neptune is pictured as rising from the sea, while at the same time being the sea; so in the pharmaceutical ethos there is a vision of a dignified pharmacist towering above shelves and counters of bottles and equipment, while at the same time being part of their essence. [11] (p. 99)

This evocative example echoes the earlier fragments that Goffman cites. We take this excerpt to demonstrate further the argument that humans could not inhabit "personas" without a host of "things", which in turn find a place in the world through their role in the stabilization of roles and identities in practice. Performance is here understood as inherently *collective*: any character is stabilized only in a collective, successfully staged scene that relies on a host of "others". This appreciation of the collective effort of performance, which is required for reality to be brought into being and stabilized, is we argue compatible with a performative sociomaterial perspective.

7.2 What Goffman's Notion of Performance Contributes: Locating Technology

Sociomateriality is often associated with the term "entanglement" [13, 16], referring to an ontological inseparability between things and people, and sociality and materiality, in practice. While we acknowledge the significance of this concept, we also recognize that the language of entanglement can be challenging for the research process because it leaves us with the question of exactly what is entangled and how entanglements play out in practice. In Goffman's conceptualization of performance, we are given a number of useful terms that we argue can help us in teasing out the different ways in which

humans and non-humans may be implicated in and contribute to collective performances. We here offer a brief introduction of these terms and speculate on how they could apply to sociomaterial studies of IS phenomena.

Goffman [11] uses the term *setting* for the environment in which a performance takes place; *sign-equipment* for props; *team* and *team-mates* for the performing group; roles such as *the director* for members of a performance who hold special access to the impression of reality that is being fostered; and *audience* for those who are being performed to. Some of these terms have been previously explored in IS literature (e.g. [25]). What we believe is underdeveloped, however, is a sociomaterial interpretation of these terms.

While any analytic language will have to cut a phenomenon in a certain way (and the performance language is no different), the performance notion as we interpret and present it here does not make any assumptions a priori about the being or identity of entities involved in a particular performance; it is the project of the researcher to provide their interpretation of the situation aided by the performance lens. Importantly for the study of the sociomateriality of IS phenomena, the lens we present does not make a priori assumptions about whether characters or entities involved in the performance are filled by human or non-human actors. This allows locating technology in various places and roles within a performance. In the following we interpret and illustrate a sociomaterial application of selected terms.

Technologies as Setting: A more conventional way to consider technologies in a performance might be to focus on their role as setting. This is how IS literature has most commonly made use of Goffman [11], to show how a particular software platform, such as Facebook for example, can act as a front stage or back stage space for performance of identity. In this analogy we might consider how a technology provides a space within and upon which "team-mates" can plan and stage their performance. For example, an Enterprise Social Network may become a stage upon which employees can demonstrate their allegiance to the organization, with the understanding that managers are monitoring the platform. An instant messaging system on the other hand might provide a back stage space within which more covert actions can be planned. In this way the concept of *technologies as setting* can be shown to sustain action in a way that is inherently *sociomaterial*.

Technologies as Sign-Equipment: A further straightforward application of Goffman's performance terminology in IS would be to say that technology can act as *sign-equipment* that helps actors to display their status, position, and identity. For example, a doctor may carry an iPad as a signal that they are engaged in contemporary healthcare, or a laptop could be a signal that a worker is not tied to a fixed desk.

While these two conceptual categories of technologies as *setting* and *sign equipment* are potentially useful, we suggest that a more radical re-reading of Goffman is possible, and that this reading is of interest to researchers examining emergent phenomena in IS from the perspective of sociomateriality. We use a call centre setting in the following examples to illustrate opportunities for future research.

Technologies as Team-Mates: In some research contexts work performance may be investigated by positioning technology as playing the role of a *team-mate* in the staging

of a performance. Team-mates bestow other actors in a performance with credibility, as they support the impression of each other's characters. An algorithmic Decision Support System (DSS) in a call centre, for example, could therefore be considered a *team-mate* to the phone operator in the staging of a performance where the phone operator's credibility and identity is in no small part in the hands of the DSS.

Technologies as Director: In stricter call centres, where the operator has very little autonomy in their role, such an algorithmic DSS companion may even be understood to be playing the *role of director* in the performance. That is, the concept of technology as director can be used to describe a scene where, for example, an algorithm controls the development of the scene's action to a greater extent than the human actor.

Technologies as Audience: Equally in a call centre context, an emphasis on socio-material performance from a Goffmanian perspective would also require the researcher to consider the *audience's* contribution to the scene because Goffman [11] reminds us that all performances are vis-à-vis another party. Is the customer who is served by the call centre the *audience* of the performance? Certainly, but in most call centres, technology introduces further audiences, such as when the call itself is recorded for later review or aspects of call "performance" (such as length) are automatically recorded and measured. As a result, the phone operator's performance becomes staged in relation to an entire collective of human and non-human audiences.

We thus point out that *multiple* audiences often shape performance. Of particular interest to IS researchers might be when technology itself becomes the audience of a particular performance. Think further of sensors in a factory. These may well be usefully understood in compliance practices as the audience towards which certain work practices are performed (e.g. [26]). Or take Introna and Hayes' [27] study on plagiarism detection software; here the software becomes a major audience for and even changes and shapes the performance of essay writing, in that the success of the performance hinges in no small part on whether or not it is "appreciated" by the algorithm-as-audience, thereby performing identities such as the "successful student" or the "plagiarizing cheat".

Through these examples we demonstrate, firstly, the usefulness of the performance lens, as we have interpreted it, in locating technology in particular empirical phenomena without making a priori assumptions about what exactly technology is; and secondly, that technology can be located in any role or part of a performance. This sensitization to different elements of performance thereby opens the researchers' attention to the possibility that a performance may involve more than what is immediately visible or intelligible with taken-for-granted notions of technology as merely a "tool" or "platform". Thus, a research emphasis on performance here encourages a differentiation of what is *entangled*, in a way that tries to avoid deciding in advance how a sociomaterial collective is involved in the maintenance of a particular reality.

By interpreting Goffman's [11] notion of performance in light of a more post-human understanding, that remains open to how technologies and people are configuring each other in practice, we can potentially make sense of these scenes of action in a more nuanced way, by carefully considering in-situ what roles various people and technologies play in the scenes that we bear witness to as we research IS phenomena. It further stands to reason that adopting a serious performative interest in

sociomateriality research requires researchers to reflect on how their own presence in the research setting is involved in the scene of action. Our audio recorders and notebooks for example introduce unspecified audiences into the performance arena. We suggest that such a reflexive approach to research methodology [28] is a necessary component of conducting research from within a performative ontology, but this goes beyond what we can consider in detail in this paper.

8 Conclusion

We have carried out a hermeneutic reading [15] of interconnected texts to critically consider how "performance" is understood in sociomateriality research. We find that while this term has been put aside in influential performativity texts, it is caught up in literature that is potentially useful to IS researchers interested in sociomateriality. As with any text, Goffman's work in particular is a product of its era and we acknowledge that adaptation and interpretation is necessary to make his notion of performance useful to a more post-human orientation [12]. We argue, however, that Goffman's [11] original conceptualization of performance is already largely compatible with a performative understanding, which holds that reality is brought into being and sustained in action.

Finally, the word "enact" no doubt has its place, particularly when referring to how boundaries, objects, and materialities come to be stabilized in practice. It is the work that goes into these practices, however, that we argue is usefully conceived of in terms of performance. We have illustrated a sociomaterial reading of Goffman using the concepts of *setting*, *sign-equipment*, *team-mates*, *director*, and *audience*. We further propose that when researchers conduct ethnographies in particular, they are involved in a scene, and that a greater sensitivity to how this scene is playing out may offer a starting point for meaningfully taking into account the complexity of the sociomaterial performances we witness, and help shape, through the research process. In sum, we put forward for further discussion the notion that boundaries are enacted, but that they are enacted in and through *performance*. In taking this as a premise for debate we looked to Goffman for an illustrative starting point and argued that his notion of performance can be usefully conceptualized for a sociomaterial IS research agenda.

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Performing Cyborgian Identity: Enacting Agential Cuts in Second Life

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Abstract. As people live their lives online more and more, they increasingly rely on digital bodies to extend their senses and to perform identities. With this hybridization of physical and digital embodiments, they become cyborgs and are compelled to negotiate the dualistic space defined by the binary opposition of actual and virtual reality. Whereas actuality typically connotes concrete existence, virtuality signifies phenomena that are ideal, essential and unrealized but that have actual effects.

This paper seeks to understand how individuals negotiate the liminal space that combines virtual and actual reality, especially as it relates to their sense of self, in their performance of cyborgian identities. Drawing on Boland's [1] Engine of Inquiry and Barad's [2] agential cuts as a conceptual infrastructure, this paper analyzes one identity performance of a single Second Life user in order to answer the following research question: *How are cyborgian identities enacted in virtual worlds?*

Keywords: Performative identity · Material-discursive practice · Virtuality · Actuality · Cyborg · Avatar · Second Life

1 Research Motivation

In a society marked by globalization, virtual work and the use of social media, individuals are increasingly experiencing their lives in a liminal space that combines virtual and actual reality [3]. By posting blogs, images, tweets, profiles and films that materialize them in multiple settings, technology users create digital bodies that extend their physically embodied senses and turn them into cyborgs [4], that is, a dialectic synthesis between physical and digital bodies [5]. In light of these multiple embodiments the production of self-identity, that is, "the self as reflexively understood by the person" [6] (p. 52), becomes an increasingly complex project that involves the ongoing negotiation of what identity performances count as "real".

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Despite the recognition that reality and virtuality are inextricably intertwined and mutually constitutive, the virtual is nevertheless frequently separated from the material conditions of daily life [3]. Indeed, the virtual is often conflated with digital environments [7], such that the computer screen becomes the stable boundary between the real and the virtual. However, adopting a definition of virtuality as "that, which is so in essence but not actually so" [8] (p. 2), this paper regards virtuality as a potential reality that stands in opposition to the actual rather than the real.

In order to better understand the dynamics of how identities are produced in the liminality of cyberspace and the dialectic synthesis of people's physical and digital bodies, this study seeks to answer the following research question: How are cyborgian identities enacted in virtual worlds? Adopting a performative lens, identity is defined as an ongoing becoming generated by the repeated enactment of material-discursive practices [2]. Given the hybridity of the identity performances in virtual worlds, this paper focuses particularly on one set of identity practices, namely agential cutting. It is through this practice that virtual and actual aspects of cyborgian identity are cut together/apart.

To answer the research question, this paper draws on empirical material from a study of the avatar–self relationship in the virtual world, Second Life (SL); specifically, the case of Rene, a 33-year-old woman who enacted an avatar named Angela. In addition to Barad's [2] notion of agential cuts, Boland's [1, 9] Engine of Inquiry will be used as the theoretical infrastructure to outline the dialectic space of the virtual and the actual within which Rene's cyborgian identity emerged.

The paper proceeds as follows: prior research on identity performance in virtual settings is briefly reviewed. This is followed by an overview of actual and virtual reality, the Engine of Inquiry and agential cuts, which collectively constitute this paper's interpretive scaffold. The data collection and analysis method is described next. The presentation of the data analysis will be followed by a discussion of the paper's contributions and implications.

2 Cyborgian Identity Performance

As the literature on identity performance in computer-mediated settings is vast, illustrative examples of different conceptualizations of cyborgian identity will be presented along the following lines: identity as multiple vs. fixed, and identity as representational vs. performative.

2.1 Identity as Multiple vs. Fixed

Turkle's [10] research on multi-user dungeons (MUDs) demonstrated how MUDers used different windows to simultaneously role-play multiple online identities that were unavailable to them in their real lives. The virtual bodies that emerged in these performances were seen as a product of mind, distinct from the user's body [11]. While this conceptualization of cyborgian identity re-produced the Cartesian cut between mind and body, it also highlighted the fragmented and distributed nature of self-identity.

However, Turkle's research was criticized for presenting the self as disembodied [11], overly fragmented [12], and insufficiently concerned with sociality [13]. For instance, Shiano [14] reported that most LambdaMOO participants tended to have only one, at most two, avatars and that they strove towards a stable self-presentation to produce long-term social cohesion.

In contrast to depictions of cyborgian identity as multiple and fragmented, other research on virtual worlds has treated the self in more essentialist ways, conceptualizing it in terms of a true, an actual, an ideal and a virtual component [e.g. 15]. For instance, Bessiere et al.'s [16] research on identity exploration in World of Warcraft revealed that the discrepancy between players' virtual and ideal selves was smaller than that between their actual and ideal selves, suggesting that avatars represent not only stable, aspirational identities, but that users have defined identities prior to taking action. This research thus reflects a representational perspective on identity.

2.2 Representational vs. Performative Identities

Identity performance can be approached from either a representational or a performative perspective. Representational identity implies that a core essential self not only pre-exists an individual's identity performance, but that it is also the source of such self-presentations [17]. From a representational perspective, virtual bodies are conceptualized as more or less passive signifiers that refer to – and are separated from – the user's original (physically embodied) identity. Research concerned with virtual identities' correspondence to the actual self [e.g. 18] is indicative of representational theorizing.

From a performative perspective, in contrast, the self is regarded as the outcome of identity performances, which in turn are the result of unconsciously citing discursively defined practices [19]. Butler [19] argues that, rather than being born female, one becomes a woman by performing such normative practices as putting on make-up and shaving one's legs, which are classified as feminine. In short, an individual is being performed through the enactment of materially and socially constrained practices rather than presenting his/her sense of self. Schultze [20] offers empirical illustrations of performative identity, highlighting that users of a virtual world found themselves becoming who their avatars had performed through mundane everyday practices of the body, such as dressing and gesturing.

3 Theoretical Framework

In much of the research on immersive environments, virtuality is defined in materialist terms, drawing the boundary between virtual and actual reality at the interface of the digital environment [7]. Upon donning a head-mounted display in a virtual reality setting or logging in as a 3D avatar, the user is deemed to transition into the realm of the virtual [21], which is frequently regarded as an alternative to the real [8] (p. 46). However, these fixed distinctions belie the complex interaction between the virtual and physical reality in everyday life. The increasing entanglement of people and technology calls for a more dynamic conceptualization of the liminal space in which individuals perform identities

these days [22]. To this end, a conceptual framework that makes this dynamic and liminal space accessible is developed.

3.1 Virtual vs. Actual Reality

Even though the virtual is frequently framed as the opposite of the real, this is a false dichotomy in that "virtual" means "almost" and "as if", implying that the virtual is "that, which is so in essence but not actually so" [8] (p. 2). What qualifies the virtual as reality is that it produces an effect that has physical existence without becoming material itself. For example, an analytical model reflects a virtuality in that its conceptualization of the phenomenon (e.g. the US housing market) represents the phenomenon in essence but not in its "concrete present" form [8] (p. 29). However, such virtual representations are used to make decisions that affect – in real life – the phenomena they model [23].

Such analytical models also reflect an idealized version of an empirical situation; they serve as maps, plans or simulations of phenomena, outcomes and effects as they should materialize [24]. Capturing the "virtue" roots of virtuality's etymology, such models highlight that the virtual represents the "ideally real" [8] (p. 29). Rather than being a mere abstraction, the virtual represents the potentially real [24].

The actual, in contrast, is associated with manifest existence and concreteness [8]. It also connotes objectivity (i.e. existence independent of an individual's attitudes, beliefs and perceptions), authenticity and permanence. As such, the actual is easily conflated with a definition of the reality that refers to the manifest, experienced world [25]. However, in this paper, an experiential view of reality is adopted, which maintains that realness is a matter of degree: objects, actions, thoughts and feelings are experienced as more or less real [25].

While the virtual and the actual are binary opposites, prior research on identity performances in virtual settings highlights a contradiction between them. Users maintain that in virtual settings they are able to enact their true self [26], which remains inaccessible to them in their actual lives. This suggests that the virtual is experienced as more "real" than the actual. The dialectic between the actual and the virtual thus creates tensions that are not only generative but that also render each pole's meaning dynamic.

3.2 The Engine of Inquiry

Boland's Engine of Inquiry seeks to explain why conversations [1] and organizational debates [9] – such as those between rational and normative organizational control structures [27] – are never settled but keep revisiting familiar topics in wave-like oscillations. The objective of the framework is to uncover the mechanism through which this dialectic dynamic is produced and sustained.

The Engine of Inquiry suggests that the structure of language – especially the binary oppositions it creates and its metaphorical nature – produces a perpetual motion machine. Drawing on Lakoff and Johnson's [28] experiential view of language, which argues that metaphors are a way of mapping embodied experiences (e.g. moving up or down) to utterances (e.g. climbing the corporate ladder) to make language meaningful (i.e. up is good, down is bad), the framework constructs an oppositional meaning space.

Thus, despite its focus on discursive practices, the Engine of Inquiry fundamentally rests on an embodied – and therefore material – understanding of language.

Lakoff and Johnson [28] note that four schemas underlie the metaphorical structure of everyday language. The four schemas – here illustrated by examples taken from Quinn's [29] research on the ways in which American couples talk about and make sense of marriage – are: ENTITY (marriage as an "indestructible natural object"), CONTAINER (marriage as "being in the same boat"), TRAJECTORY (marriage as an "ongoing journey") and RELATION (marriage as an "unbreakable bond"). Importantly, multiple schemas may be applied to any given phenomenon at the same time.

The Engine of Inquiry suggests that, when multiple metaphor schemas are applied to understanding the binary opposition that informs a phenomenon, tensions arise between them, thus giving rise to the wave-like oscillations that keep boundaries and meanings unsettled. Below, the framework will be described using the virtuality–actuality opposition as it relates to gaining self-knowledge through identity performances in virtual worlds (Fig. 1).

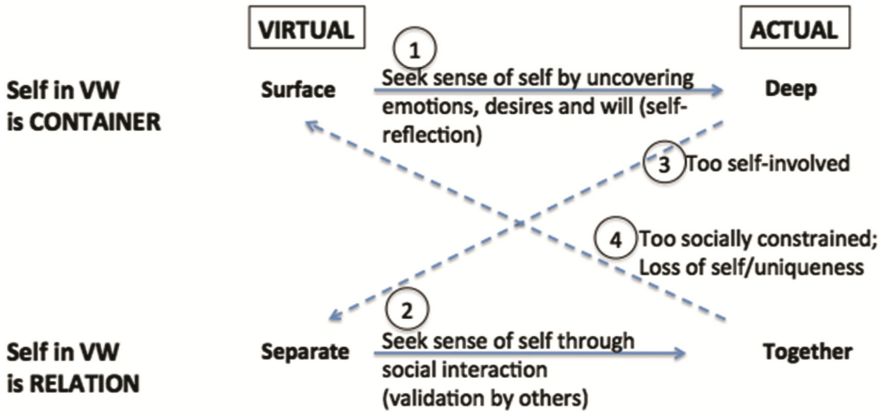

Fig. 1. Dialectic process of performing cyborgian identity

Based on the language used to describe virtual worlds (abbreviated as VW in Fig. 1), the metaphorical schemas of CONTAINER and RELATION seem central to structuring the users' production of what is actual versus virtual. For instance, expressions like "logging in", being "in-world" and having an "immersive" experience, indicate that the simulated world is a container that we can enter or leave (like a building). Virtual worlds are also described as "social networks" in which people form "groups", "friend" each other and become "partnered", thus highlighting the relational nature of virtual worlds.

How the distinction between the real and the virtual pole is expressed depends on each schema's entailments in a given context. As a spatial metaphor, the CONTAINER's entailments for performing identity have to do with locating oneself in space. For instance, going deep (i.e. into the center) implies a movement towards the true self associated with actuality (e.g. getting in touch with one's core values; the heart of the

matter). In contrast, staying on the surface or periphery signals virtuality in that it implies pretense and superficiality (e.g. putting up a front; faking).

With regard to the RELATION schema, being together with others in meaningful ways is associated with individuals feeling real (e.g. having a sense of belonging). According to Goffman [30], the self depends on interaction to exist socially, implying that social beings need to both present the self to others and to have this performance validated by others in order to materialize as a social being.

In contrast, being separate and isolated (e.g. thinking only of oneself) is indicative of being virtual. Giddens' [31] notion of a "pure relationship" is illustrative of virtuality as defined by the relations metaphor. Entered into for the intrinsic satisfaction they offer and maintained only as long as they deliver enough gratification, participants draw clear personal boundaries rather than become absorbed in and committed to each other in pure relationships. The advancement of the self rather than the development of the couple characterizes this liaison. Being "alone together" [32], i.e. having the assurance of potential connections to virtual others without actualizing relationships, provides another conceptualization of the self as virtual as entailed by the relation metaphor.

Having outlined the structural elements of the framework, we now turn to its motion. Arrow 1 in Fig. 1 indicates the natural trajectory of reflexive self-discovery, where idealized avatar-based identity performances that may be 'as-if' (virtual) nevertheless generate insights into the user's true emotions, deep desires and core values (actual). Similarly, arrow 2 signifies a natural search for meaningful social connections as one's sense of self depends on it. This suggests a progression from an identity performance that is self-absorbed (virtual), to one that recognizes its interdependence with others (actual).

What turns this framework into a perpetual motion machine, however, are arrows 3 and 4, which represent a switch in the schema used to organize one's experiences. Importantly, switching metaphorical schema instantiates a reversal of meaning. For instance, while being in touch with one's deep-seated emotions and core values is indicative of being true to one's actual self within the CONTAINER schema, from a relational perspective such behavior may be self-indulgent and inconsiderate of others' needs. Thus, what is deemed actual in the CONTAINER schema, is virtual on the RELATION register.

Similarly, while the actual pole in the RELATION schema is characterized by being dependent on and socio-emotionally entangled with others, it also implies a loss of self as individuals subjugate some of their uniqueness for the sake of social harmony. The high degree of social agreement that signifies the actual in the RELATION schema thus simultaneously implies virtualness in the CONTAINER schema. The reversal of meaning associated with a switch in metaphorical schema ensures that individuals' questions about who they are and who they might be as cyborgs is never settled. As such, the Engine of Inquiry represents a performative view of language in which utterances do not only represent phenomena, but also produce them [33].

Since Boland [1, 9] argues that schema switches occur when a metaphor has been saturated or pushed too far, the Engine of Inquiry offers us a theoretical framework for understanding when and why users of virtual worlds segment their fluid and ongoing experience as a cyborg into more or less "real" aspects as they make sense of their

identity performances and of their emergent self-identity. Barad's [2] concept of agential cuts as material-discursive practices provides a conceptual infrastructure for theorizing this process of identity enactment.

3.3 Agential Cuts

Barad's [2] agential realism advances a fully relational ontology in which entities only exist in relation to others. Phenomena (e.g. selves, technologies) have no existence independent of each other; rather they are brought into being in practice. Instead of a world made up of discrete entities that are brought together through interaction, Barad [2] conceptualizes a world made up of fluid entanglements that are separated through agential cuts.

Nyberg [5] offers the following example of agential cutting: call center customers experience the components that constitute service delivery (i.e. the telephone system, the computer systems, the customer service representative, etc.) as an entangled whole until customer service representatives distance themselves from the (failing) technology with such utterances as "the computer has a mind of its own". Enacting such cuts between technological and human actors, the elements in a sociomaterial assemblage are given identity, properties and agency.

However, Barad highlights that agential "cuts are enacted not by willful individuals but by the larger material arrangements of which 'we' are a 'part'" [2] (p. 178). In other words, agential cutting is not merely a discursive act performed by an agential individual, but the performance of everyday material-discursive practices that draw on the sociomaterial infrastructure in which an individual is entangled. Furthermore, "cuts cut 'things' together and apart. Cuts are not enacted from the outside, nor are they ever enacted once and for all" [1] (p. 179).

Combining Boland's Engine of Inquiry with Barad's agential cuts, we note that schema switches are indicative of agential cuts as the diagonal arrows indicate a severing of the cyborgian entanglement between the user's self-identity and his/her identity performance in avatar form. Our empirical data analysis demonstrates how this conceptual framework provides us with insight into how cyborgian identity is enacted in virtual worlds.

4 Method

To explore cyborgian identities in their constant state of becoming through the ongoing negotiation of what counts as real in the intertwining of actual and virtual reality, this paper relies on a single case of a female resident of Second Life, who was interviewed as part of larger study of US-based SL users that spent at least 10 h a week in-world. Given the need for a micro-level analysis of the material-discursive practices of agential cutting that this paper seeks to explore, a single case offers the requisite empirical richness.

The case was chosen for its potential for generating insights into the dynamic nature of cyborgian identity performance. The participant, Rene,[1] had considerable experience in virtual worlds, having spent 10 months in SL and a number of years in MUDs. She was also very introspective and articulate. Moreover, she used her avatar, Angela, for highly personal and profound identity work. As such, Rene might be classified as an extreme case [34], in that her use of SL demonstrated cyborgian identity performance naturally and intensively, thus enabling comprehensive theorizing.

Rene was 33 years old, single and a minority: part African American, part Native American. She had attended a highly competitive magnet high school for the talented and gifted, and subsequently earned an undergraduate degree in Management Information Systems, as well as a Masters in Business Administration. At the time of the interview, she was working in a small insurance office, where she dealt with accounts payables, receivables, newsletters, and client relations.

Rene had initially entered SL to learn more about Gorean role-play, which enacted unconventional intimate relationships. Instead of joining an established role-play community though, she developed her own character and role-play scenarios with close friends. Angela played both dominant and submissive roles. As a dominant, Angela had three male submissives; as a submissive, she had a master (Ira), with whom she was also "partnered" (i.e. married) in SL. Together, these four men made up her "SL family".

Data were collected in two phases during Fall 2008:

- A 2-hour, face-to-face interview: After meeting briefly in a coffee shop, this interview was conducted in the author's office, which offered privacy and Internet access so that Rene could log onto SL and provide the researcher with an overview of her life there. A key objective of this in-person meeting was to build the rapport and trust needed for the longitudinal data collection that followed.
- Three 1-hour phone interviews about Rene's weekly photo-diary: Diary methods approximate observational research, but rely on research participants to serve as adjunct ethnographers, capturing naturally occurring events, as well as their meaning and significance. Following Latham [35], Rene was asked to proceed with their SL activities as normal, but to take a snapshot of events that were in some way meaningful, significant or important to her. Each snapshot was then annotated by answering when, what, why, who and how questions. Each photodiary included five snapshots and was submitted to the author ahead of the scheduled phone interview.

Given the considerable time commitment required, Rene was paid $150. With her permission, all interviews were tape-recoded.

Data analysis proceeded as follows:

1. extracting excerpts from interviews and photodiaries related to identity performances and the production of self-identity;
2. evolving the metaphorical schema outlined in Fig. 1; even though the Engine of Inquiry was presented in the theory section, Fig. 1 represents an empirically grounded adaptation of the framework;

[1] All names are pseudonyms.

3. developing situated meanings of virtual and actual reality; the meanings Rene associated with the positions that made up the dialectic space (surface, deep, separate, together) were identified (i.e. Table 1); and

Table 1. The dialectic space of cyborgian identity performance

	Virtual	Actual
Self in virtual world is CONTAINER	**Surface** • escape; endless possibilities through playfulness and creativity • avatar as character distinct from user's self-identity	**Deep** • quest to recover true self and uncover hidden facets of self • avatar as extension of user's self-identity
Self in virtual world is RELATION	**Separate** • game: inconsiderate of others' feelings; no morals, lying, misrepresentation • self-centered: acting in own self-interest	**Together** • simulation of real life: moral obligation to person behind avatar • family: commitment to others

4. tracing the dialectic movements of specific identities; to demonstrate the pendulum-like motion of performing cyborgian identity, various identity performances were traced through the framework. Agential cuts were also identified. One of these identity performances, i.e. Ira's partner, will be presented below.

5 Empirical Analysis

5.1 Dialectic Space: Virtual vs Actual

Table 1 summarizes the dialectic space through which Rene defined the various meanings of virtual and actual reality. Importantly, the empirical examples used to develop this meaning space demonstrate the intertwined nature of meaning/discourse and matter/technology.

Surface. Rene's principal use of SL was as a diversion and an "escape" from her "real life" (RL), which she described as "out of control" and "unfulfilling". Discursive practices of distinguishing "Second Life" for "first" or "real life" enacted the virtual as a distinct space separate from actual reality:

> When I go in Second Life most of the time, it helps me just not think about [my RL worries]. It helps me regain some control over my happiness and I just don't even think about [RL].

Engaging primarily in role-playing and building, both of which represented playful, creative expression rather than a quest for self-knowledge for Rene, she enacted the virtual as a place of endless possibility:

> And I think that's what I like the most about role-playing online because you don't have any boundaries. It can be whatever you want it to be.

Creating an avatar with a different name and an appearance that did not mirror Rene's physical embodiment – Angela had a light complexion and waist-long, yellow-blond hair and wore "edgy" outfits that Rene would never wear – produced Angela as a character that was not only distinct from Rene's self-identity, but also independent of her player:

> Suddenly she [Angela] is her own person. I mean, she's me, but she's has her own persona; she has her own style.

Deep. Paradoxically, the separation between the virtual and the actual that such material-discursive practices as anonymity, role-playing and world-building produced, also created the conditions for identity work. Self-reflection and experimentation with alternate ways of being made it possible to gain deep self-knowledge, implying a profound entanglement between users' avatar-embodied identity performances and their sense of self. Observing her identity-performance as Angela, Rene noted that she became a different person in SL even though "mentally" her avatar was indistinguishable from her:

> She's me! [Laughter] I don't know. I mean, mentally she's me … She's a lot tougher than I am. [Laughter] That's for sure. … Oh, because I'm a wimp. … when I role-play her, she pretty much stands her ground. Whereas me in real life, I don't always have that in me, you know. I can be somewhat of the push-over.

Rather than making distinctions between herself and her avatar, Rene created continuity with Angela:

> Angela is an extension of me. So if somebody offends her, they're offending me because she is my personality. She is my creativity. … I'm playing me, you know. I'm my personality. I'm playing her as if; if I had these capabilities this is what I'd do. And somebody insults or disrespects that, it's a lot more personal.

Rene thus acknowledged that SL not only had an effect on RL, but that events in virtuality were likely to be more consequential to the self (i.e. injuries are "a lot more personal") than actual events. Given that online identity performances were seen as an expression of the user's creativity, and supposedly less encumbered by actual constraints such as the user's physical embodiment, for example, insults in SL struck Rene in her core.

Separate. Misrepresentation, lies and morally questionable behavior were ways in which SL relationships (re)produced virtuality. For example, Rene had role-played with Carl who claimed to be unmarried in RL. After she had allowed herself to fall in love with him, she learned that he was actually married. She concluded that "[SL]'s a fantasy world, and you do come to realize that a lot of people don't take it so seriously". Subsequently, she classified all interactions with Carl as "strictly SL", thereby changing her "perspective on the time that we spent together and what it means when we are together".

Even though she had struggled to deal with Carl's deceit, she vigorously defended her right to present herself in non-representational ways:

> There's this guy I was becoming friends with. … He asked for a photo of me [in RL]. And the moment he saw it, he said, "Hmm, different". And then he took me off his Friends List and put me on mute [i.e. blocking all her messages to him]. Because I didn't look like Angela. Nobody

> in SL looks like their avatar! It's always an exaggerated perversion of who they are. And who's to say that I have to be some half Native American, half black chic. … It doesn't make sense. It is a fantasy world after all.

Together. Even though Rene engaged in role-play most of the time, she maintained that she performed an identity that was in line with her self-identity:

> And there's some people that are so extreme into their fantasy world that you'll never see who they really are and what they're really like. Whereas, I try to be as true to myself as possible.

She resented when people treated SL like a "game", with which she associated a lack of consideration for the feelings of the actual person behind the avatar:

> I don't approach it [SL] as a game like some people do and that's probably my biggest pet peeve because it's a simulation of life. It's not an actual game. … You're dealing with real people, real feelings. So even though the environment is fake and the avatar is fake, the person behind it – the personality, the emotions – everything is real.

The home that Rene built for her SL "family" (i.e. her "master" and three submissives) made these relationships "real", "solid" and permanent, implying that they persisted outside of SL also:

> You know the family was already established, it's just now [with my SL home completed] it feels real and solid and you know, unbreakable. … It's not like I'm just floundering. I have a real home, I have, you know, definite family … it's not going away.

5.2 Perpetual Motion: Performing Cyborgian Identity

Having outlined the meanings Rene gave to the four positions in the dialectic space marked by the virtual–actual opposition, her movement through this space will now be traced using one of her identity performances. Figure 2 summarizes her ongoing becoming as a partner to her "master" and "husband", Ira.

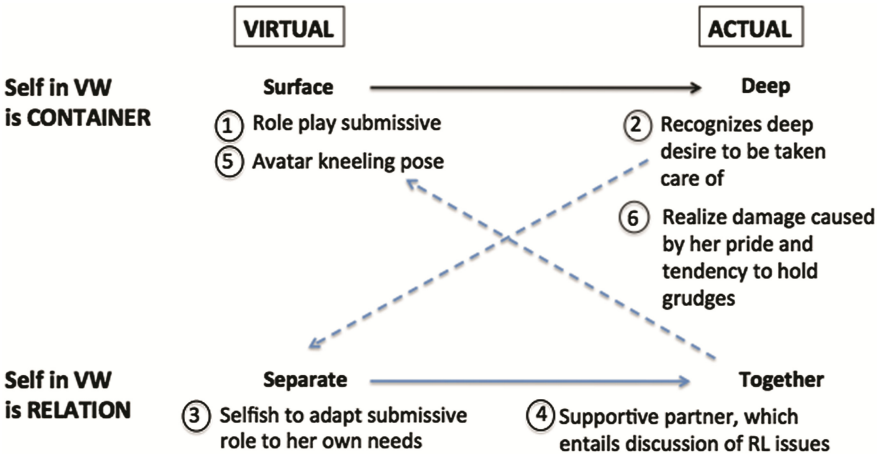

Fig. 2. Performing Ira's partner

When Rene first met Ira, she was reluctant to role-play with him because he was looking for a submissive and she considered herself too dominant to pull off that role:

> [As a submissive] you're giving up yourself; you're opening yourself completely to another person. You're at your most vulnerable because they can make decisions for you and they can basically … determine how you should feel and what you should think, etc.

Nevertheless, she decided to role-play the submissive (1: surface):

> Angela's role from the moment that she met Ira was always a submissive. … if I'm being a submissive with Ira in SL that's more Angela than Rene.

"Being a submissive with Ira" was enacted through such material-discursive practices as wearing "his collar" and "silks" (i.e. bikini top with skirt slit up both sides), performing acquiescent poses (e.g. kneeling) and addressing Ira as "Master". Even though playing this role was "more Angela than Rene", it made an inaccessible, "hidden side" of Rene available to her, highlighting a deeply held desire to be taken care of (2: deep):

> She [the submissive Angela] is a hidden side of me that I don't think I could ever express in real life. … I love the feeling of being safe and protected and cherished, like you're their number one jewel in the whole world.

Indicative of the lack of separability between her sense of self and her role as Ira's submissive partner, Rene found it difficult to maintain a subservient attitude. She noted that she rarely performed submissiveness when she was with Ira, which raised questions about the status of their relationship (3: separate):

> We've had conversations before where he wasn't sure if it was what I still wanted to be partnered. And it's important for me to kinda reassure him that it is what I want. Because I don't want him to feel uncomfortable or for him to feel like he's not as important to me in my life anymore. So when we're on SL, we try to role-play … sometimes when we are talking about real life things, I have to remember who I am in my SL avatar and how I should really relate to him and how I should behave around him.

This interview quote illustrates Rene's realization that her identity performance entangled too much of her actual, dominant self at the expense of Ira's needs. It thus highlights not only a switch in metaphorical schemas (from self as CONTAINER to self as RELATION), but also an agential cut as Rene recognizes that she needed to be "who I am in my SL avatar" whenever she is interacting with Ira in SL. She enacted this cut by performing such material-discursive practices as wearing silks and calling him "Master". These practices helped her "relate to [Ira]" and "behave around him" in the way that she "should".

Rene's desire to perform her role as a submission more credibly in order to fulfill Ira's emotional needs, paradoxically also produced a "real relationship" that involved the people behind the avatar (4: together). This meant that Ira and Rene talked about RL issues more and more while in-world. Rene, however, became increasingly frustrated as conversations about their actual lives dominated their interactions in SL:

> And that's not bad [to talk about RL] like once a week, but when every time I talk to him it's the same thing, it starts to get a little annoying to me. And it starts to depress me. It really stresses me out, because then I start worrying about what's going on with him [in RL]. … And it's just

> like, "can we just forget about it all for a bit while we're on SL and just try to be happy and not think about the problems for just a little bit?" Because that's kind of the whole point of SL.

The interview quote suggests that her identity performance as Ira's partner had become too "real" in that it was no longer submissive–dominant role-play; instead Rene was "worrying about what's going on with him [in RL]"). The "stress" this caused Rene suggested that their SL liaison had gone too far and had lost its playfulness and promise of escape.

One particular incident highlighted the challenge associated with their relationship becoming too real (i.e. "crossing the line"); Rene had become "really mad" at Ira for failing to take her side on an issue:

> I should not have gotten that upset with him. And that's probably one of the problems with having real life relationships and SL relationships, because sometimes you forget your role, your place on SL and [by getting mad with Ira] I definitely crossed the line there.

To restore her identity as Ira's submissive partner, Rene relied on her avatar's animations, especially the kneeling pose, to enact an agential cut that separated her sense of self from her identity performance as Ira's partner (5: surface):

> Probably the conversation initially was more Rene with Ira's player and then [once in a kneeling pose], it's more, "okay, I'm going to be Angela, I'm going to be subservient and my master is right or it doesn't' matter who's right, I just need to respect him and get his forgiveness etc." It was like me switching from Rene to full Angela at one point.

By placing her avatar in a kneeling pose and thereby "switching from Rene to full Angela", Rene also switched from the RELATION schema to the CONTAINER schema, moving from a focus of self in relation to Ira, to one of self in relation to her avatar. The kneeling pose was also performative in that it enacted an ideal submissive. This not only enabled Rene to "respect her master" in her identity performance on SL, but it also affected her actual emotions (6: deep):

> In this moment [where she is kneeling], it calmed me down in real life too. Because I was pretty huffy. [Laughs] … I can be very stubborn and prideful and whenever I kneel [as Angela], it's kind of like it's giving me permission to let go and just do the right thing even if it affects my pride.

Furthermore, the incident made Rene reflect on how destructive her pride and her tendency to hold grudges was both in SL and in RL:

> Probably [in RL I learned] the same thing. Don't hold grudges and don't focus and complain on a matter to the point where you've crossed the line … up to a certain point it's justified but once you get past that certain point, it's just painful for everybody.

Even though the movement through the dialectic space continued in Rene's ongoing cyborgian identity performance, the length restrictions of this article prevent any further illustrations here.

6 Discussion and Conclusion

The objective of this paper is to gain insight into the ongoing becoming as a cyborg. Key assumptions underlying this research include that: (i) identity is performative,

implying that it is the result of enacting everyday material-discursive practices, (ii) cyborgian identity performances occur within a dialectic space defined by opposing poles of virtual and actual reality, (iii) based on the oppositional and metaphorical structure of language, the dialectical interplay between virtuality and actuality functions like a perpetual motion machine (i.e. Engine of Inquiry), such that neither cyborgian identity nor the meanings of the actual and the virtual will ever be settled, and (iv) agential cutting that cuts together/apart online identity performances and self-identities represents a key practice by which individuals keep a given cyborgian identity performance going.

Into the research question "How are cyborgian identities enacted in virtual worlds?" the paper's empirical analysis provides the following insights:

- The material conditions of the technology (e.g. making oneself present in a virtual body distinct from one's physical embodiment) compel users to confront questions of how the multiple, situated identities they perform as an avatar relate to their more permanent sense of self. At times, they experience their performances online as inseparable from who they are; at other times, their avatars seem to be independent entities. Rene's discursive practices, which continuously switched between "I" and "she" to describe her actions as Angela in SL, suggest that the configuration of cyborgian identity as an entanglement of avatar and physically embodied user is fluid and remains unsettled.
- In making sense of these different experiences with being a cyborg, users distinguish between their personal relationship with their avatar and their relationship with others as avatars. These two dimensions of cyborgian identity are reflected in the framing of the self as container and as a set of social relations respectively. In Rene's case, questions about her avatar–self relationship revolved around the extent to which her creativity, thoughts and feelings were entangled with Angela, and the kind of identity they produced (e.g. someone tougher than the wimp she was in RL). In contrast, her self–other relationship as a cyborg was more concerned with questions of authenticity and moral obligations, i.e. the extent to which she participated in validating others – and therefore her own – actual existence despite the fakeness of the setting.
- Even though there are many agential cuts that are enacted continuously and in ways that individuals do not consciously perceive – e.g. apparatuses like the technological configuration of SL and the material-discursive practices of separating this virtual from the actual by enacting fantasy role-play scenarios – there are nevertheless situations in which cutting is agentially performed by individuals [see also 5]. For example, when she got a sense that her performance as Angela was no longer sufficiently distinct from her dominant self (i.e. when it had become too real), Rene relied on her avatar's embodied practices (e.g. wearing a collar, kneeling) to restore Angela's identity as Ira's submissive partner. This practice of agential cutting produced Angela as a somewhat independent being with her own identity and agency. Angela's embodied actions (e.g. wearing silks, referring to Ira as "Master" in text chat) were performative in that they affected Rene's physically embodied emotions and reminded her to limit the degree to which she allowed herself to be entangled with Angela.

This research makes two key of contributions:

- Given recent calls to develop more performative and processual theories of identity work in the liminality of cyberspace [e.g. 22], this paper outlines a theoretical scaffold for how people (re)produce the dialectical space that constitutes the virtual and the actual. Boland's Engine of Inquiry [1], a framework that was developed to theorize the performativity of language, is expanded to help explain the performativity of the material-discursive practices of cyborgian identity performance. Even though this paper has demonstrated the Engine of Inquiry on a rather limited – albeit rich – empirical data set, the framework appears to hold much promise with regard to theorizing how people produce their identities in the face of the increasing entanglement of physical and digital embodiments.
- The notion of agential cuts has become part of the agenda of sociomaterial theorizing in IS research. This paper provides not only an empirical illustration of how agential cuts are enacted unconsciously through everyday material-discursive acts in virtual worlds, but it also highlights the potentially agential nature of cutting practices. As such, this paper provides empirical insight into *when* and – to some extent – *why* they are made. In particular, our empirical analysis suggests that users seek to sever their entanglement with their avatar when the identity performance becomes too real. While this insight has been developed using an extreme case [34], future research is needed to assess whether this key finding will hold in technological settings other than Second Life, e.g. social media such as Facebook, Instagram and Twitter, and other virtual worlds, e.g. Minecraft, World of Warcraft.

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Examining Knowledge and Practice

Performing Research Validity: A "Mangle of Practice" Approach

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Abstract. Mainstream discussions of research validity (truth, significance, objectivity) draw heavily on a certain "representational idiom" of science [1] that assumes a knowledge–reality correspondence. However, for research on practices, rather than nature, such a knowledge-reality distinction is neither feasible nor desirable, as it is at odds with the very notion of a "practice". Drawing on Pickering's alternative "performative idiom" for science, and extending it to participatory forms of social research, we propose alternative validity claims for practice-oriented research. Using the example of information infrastructuring practices, we show that the three aspects of validity thus reinterpreted become quite closely related to each other and also to the process of information infrastructuring itself. In so doing, we demonstrate the importance of extending the notion of "material agency" to embrace the *dual* agencies of the practice studied *and* the researcher's own disciplinary practice.

Keywords: Validity · Performativity · Truth · Objectivity · Significance · Rigour · Relevance · Mangle of practice · Infrastructuring

1 Introduction

Mainstream discussions of research validity (truth, significance, objectivity) draw heavily on a certain "representational idiom" of science [1] that assumes a knowledge–reality correspondence. Within this representational idiom, notions of research validity come to be formulated as dimensions of this putative knowledge–reality correspondence. In this paper, we ask: what should be the validity claims for practice-oriented research where it is neither feasible nor desired to adopt the assumptions that support the correspondence principle of the representational idiom?

We will argue that to answer this question we must shift the discussion of validity away from definitions that assume an observer–reality split and consider how validity is actually *performed* in the real-time, situated struggle of the researcher to bring forth

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and understand a phenomenon. We will seek to define validity in terms of attributes of the actual *interaction* between the researcher and the studied world. For this we use Pickering's performative "mangle of practice" framework [1], extending its application to the case of participatory practice-oriented research.

As a concrete example of practice-oriented research we use an approach of our own design [2] for researching information infrastructuring practices. We will argue validity in this case requires an account of research practice that fully acknowledges the real-time, emergent, social and material nature of *both* the infrastructuring practices studied *and* the researcher's own disciplinary practice. We show that the three aspects of validity (truth, significance and objectivity) need to be radically reconsidered: when understood performatively they become quite closely related to each other and also, in a particular sense, to the phenomenon that is studied.

In so doing, we address the theme of this volume by showing how an issue normally framed within an epistemology of separation of knower and known obtains a richer solution when approached from a performative and interactive perspective. Specifically, we show that in the context of strongly participatory social research Pickering's notion of material resistance must be extended, and this extension has novel consequences for claims of research validity in this context. More generally, we reaffirm that Pickering's performative approach, by emphasizing that all scientific knowledge is acquired through ongoing real-time interaction between knower and known, negates any schism between natural and social science on the question of validity.

The flow of the argument is as follows. We begin by describing Pickering's critique of the traditional "representational idiom" for science and his alternative "performative idiom". Using the latter, we present an alternative formulation of validity that is applicable even when a knowledge-world separation is not feasible. This we apply to our example case of information infrastructuring practices, analysing what Pickering's "mangle of practice" would entail in this context and what novel insights a performative analysis of validity yields. We conclude by reflecting on the generality of our arguments.

2 The "Representational Idiom" of Science and Its Problems

Pickering [1] (p. 5) argues that there is a dominant representational idiom of science that "casts science as, above all, an activity that seeks to represent nature, to produce knowledge that maps, mirrors, or corresponds to how the world really is". Within this representational idiom, notions of research validity come to be formulated as dimensions of this putative knowledge–reality correspondence.

Truth: How well does the representation correspond to its real-world object?
Objectivity: How independent is the representation of human interests and prejudices?
Significance: How broad is the class of real-world phenomena that the representation covers?

The disciplines of Organizational and Management Studies (OMS) and Information Systems (IS) have largely taken over this accepted view of research validity as part of their allegiance to science as a privileged basis for knowledge and as a basis for

disciplinary respectability. This view is so embedded in research culture through the influential scientific realist philosophy (e.g. [3]), and also through the subject–object split implicit in everyday folk-theories of knowledge [4], that research more generally tends to be held accountable against these dimensions of validity [5].[1] This is the case even for interpretive and practice-oriented research that does not by and large accept the ontological and epistemological assumptions underpinning this correspondence theory of knowledge, leading to complaints by such researchers that their work is often judged against standards they reject [7] (p. 84).

However, for research of a participatory flavour in these disciplines, because the object of study is "practices" (of organizing and IT use) it is not so straightforward to separate knowledge and reality in a way required by the representational idiom.

The first problem is the degree to which knowledge and research object can be separated in principle. If one takes seriously the notion consistent with the "practice turn" in OMS and IS [8, 9] that practices are *interpreted* material and social performances, then what is researched in practice-oriented research includes how the practitioners themselves make sense of their practices – the very same practices the researcher is studying. This makes a separation of knowledge and observed reality to the poles of a correspondence highly problematic.

The second issue is the degree to which researcher knowledge and practitioner knowledge are entangled in practice. Far from being a passive object of study, the practitioners studied are members of the broader community that commissions socio-technical research and are thus potential customers for the knowledge produced. Knowledge gained and made explicit by the research has the potential to become one of the drivers of change in the focal practices. This is particularly the case for practice-oriented research that has strong participatory or ethnographic flavour, such as our example. Furthermore, this recursive relation between knowledge and its object introduces an extra normative requirement that knowledge should be (at least potentially) useful and relevant to the practices studied. This additional validity requirement of *relevance* is frequently viewed to be in direct conflict with, or demanding a trade-off with, the standard validity attributes above [10, 11].

The attraction of the representational idiom of science is that it promises to keep the messy human process of knowledge production, as documented in numerous studies of the sociology of scientific knowledge [12–15], separate from its knowledge "product". This knowledge product, a representation, then takes on the kind of independence of humans that its object – nature – is assumed in science to have, and validity is sterilized from any trace of the human agency and work that *produced* knowledge in the first place. However, the entanglement of researcher knowledge-seeking practices with practitioner knowledge-using practice outlined above threatens to contaminate the knowledge–reality separation underpinning the standard account of validity. Must we therefore accept that the validity of practice-oriented research can never match the "gold standard" provided by science?

[1] Here we make a claim about what is experienced routinely within the OMS and IS disciplines. We recognize that there are other approaches to truth, such as coherence, pragmatic and consensus theories [6] but the correspondence theory appears to be the working folk-theory of truth in these disciplines.

3 An Alternative Account of Scientific Practice

We will argue that to answer this question we must shift the discussion of validity away from definitions that assume an observer–reality split and consider how validity is actually *performed* in the real-time, situated struggle of the researcher to understand phenomena. We will seek to define validity in terms of attributes of the actual interaction between the researcher and the observed world. Once it is understood that *all* scientific knowledge is acquired through such ongoing real-time interaction, any schism between natural and social science on the question of validity disappears.

For this purpose, we draw on Pickering's alternate performative account of scientific practice. Although it was introduced largely in the context of natural science, we will show that it can be used also to conceptualize validity claims for practice-oriented research. This is possible because this formulation of scientific practice does not depend on the usual realist assumption of an independent, separable research object to which knowledge must correspond, but rather focuses on "how, in practice, connections between knowledge and the world are made" [1] (p. 182).

3.1 Pickering's "Performative Idiom" for Scientific Practice

Pickering [1] points out that the representational idiom of science encourages a particular account of scientific progress as a gradual and inevitable revelation of a reality "out there", which he calls the "scientist's account". Importantly, the scientist's account takes reality to be described by our current understanding and then reconstructs breakthroughs that led to this understanding as an inevitable triumph of reality over earlier false theory (see also [13]). He criticizes this account for failing to acknowledge that scientists (and actors in practices, more generally) actively make unforced choices and so exercise *agency*. The actual work that scientists do in achieving a successful capture of natural phenomena through tuning mechanical apparatus and routinizing operating procedures, in interpreting data, and in revising theories and beliefs, is *deleted* from the "scientist's account". The effort and temporality of this work is replaced – through hindsight – with a story of unproblematic comparison between reality and representation in which both humans and machines are largely absent. Thus, nature is the only "agent" in the scientist's account.

By contrast, Pickering draws on extensive archival material and interviews on actual practices of scientists ([1, 16], see also [14]) to show that both choices between rival theories and evaluation of data from experiment can only be understood as involving "human agency" – intentional human choices that are conditioned by historical and cultural context. Thus, Pickering seeks to provide an account of science that makes central the agentic real-time, performative nature of scientific practice.

The basic assertion is that practices are extended from one moment to the next through the coming together of human and material agency, a process that he calls "the mangle of practice", consisting of alternating episodes of resistance and accommodation. His exemplar case is high-energy particle physics, which employs increasingly complex and large machinery to capture certain physical phenomena and allow comparison with theory. Viewed in the real-time of actual scientific practice, the capture of

phenomena is a time-extended struggle between the scientist's intentions and choices, and recalcitrant machinery. Machinery offers resistance as it produces unexpected or awkward results: the scientist tunes and retunes the machinery and/or develops new interpretations and concepts that would align with the results in an on-going iterated process. To capture the dynamism of this process, Pickering proposes to view the resistance of the machinery as a "material agency" that struggles with the human agency of the scientist. A phenomenon is understood if and when the iterated process of resistance and accommodation converges toward a stabilized agreement between explanations and experimental outcomes. Any such stabilized understanding must be viewed as an outcome (a collaboration) of both human agency and material agency. Such a stabilization is neither guaranteed nor determined by initial human intentions nor material configurations. The process is thus open and emergent: there is no purely mechanical procedure that will inevitably direct the scientist towards "the truth". Any stabilization is hard won and fragile, at risk of coming apart again through further human or material agency. This idea is depicted in Fig. 1.

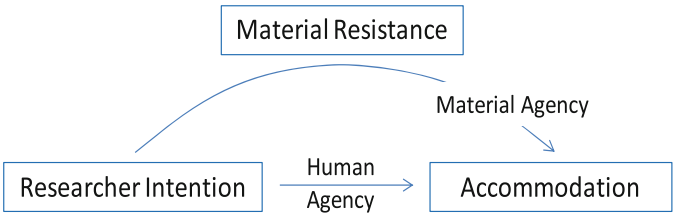

Fig. 1. The "mangle" according to [1]. Researcher's intentions encounter resistance from machinery, resulting iteratively in an accommodation of human and material agency.

3.2 Validity Under the Performative Idiom

Pickering's performative account of science replaces the notion of a representation–reality correspondence with a dynamic process of achieving a stabilized capture of natural phenomena in machinery (apparatus). Pickering [1] (Chap. 6) shows that traditional notions of validity based on correspondence must be revised and linked to the *stabilization* of the dynamic mangling:

Truth: Knowledge of a phenomenon is acquired if, and to the extent that, mangling of the researcher's agency with material agency becomes stabilized. This is not a correspondence of the scientist's abstract theoretical account with an external reality, but an *agreement* between a scientist's hard-won understanding of a natural phenomenon and how it is manifested in the performance of actual machinery. This then is a performative claim for truth.

Objectivity: As joint mangling approaches stabilization the researcher's original intentions get "mangled" by the resistance put up by machinery. The process of mangling thus enacts a performative kind of objectivity: human agency develops and evolves as a series of responses to the agency of a material "other", rather than from independently

willed moves that might force initial human plans, interests and prejudices upon the outcome. The resulting stabilization might depend on the historical and cultural context of human agency but no longer on individual initial desires, intentions or free-will of the researcher. This then is a performative claim for objectivity.

Significance: Pickering did not explicitly consider research significance. It is reasonable, though, to associate significance with some measure of the *breadth* of the phenomenon that is captured in the stabilization. This associates significance with universality of the phenomenon studied, rather than generality of a theoretical assertion. We will return to a performative claim for significance later, in the more concrete setting of our example.[2]

3.3 Moving Beyond Natural Science: Generalizing Material Agency

Our argument is that these alternate conceptions of validity developed by Pickering for the case of natural science can also be applied to forms of social science where close engagement of researchers with practitioners is involved.

Firstly, these performative formulations of truth, objectivity and significance make no reference to a putative independent "real world". They therefore do not depend on a commitment to a realist ontology or an epistemology of separation between knower and known. They require only a genuine iterative interaction (mangling) of researcher agency and the resistive agency of the "machinery" that captures a natural phenomenon. Secondly, even though they were derived for the case where the phenomenon is captured in the machinic performance of experimental apparatus, they do not depend on this setting. Therefore, we can apply this analysis even when the phenomena investigated are social in nature and are captured in human social performance (human practices) where a realist separation of knowledge and world is untenable. Thirdly, the performative idiom captures how knowledge is actually accumulated, refined and tested in the face of, and actually *as a result of*, the resistance offered by the world to the researcher's knowledge-seeking intentions. This means that strong involvement of researchers with their object of study, characteristic of engaged forms of practitioner-oriented research (including our example), does not preclude strong claims for research validity in social science.

However, any application of the mangle of practice beyond its natural science origins requires the notion of material agency to be generalized beyond the resistive agency of apparatus. Some extensions have already been considered by Pickering [1] (see Chaps. 4 and 5) and in the next section we will extend the idea to the resistive agency of socio-material practices. First we will describe the general principle involved and then Pickering's own initial extensions.

It needs to be stressed that, even in the original experimental science setting, Pickering's notion of material agency is not referring to autonomous or cybernetic behaviour on the part of physical mechanisms. Rather, material agency is a product of the

[2] In the language of dynamic systems theory [17], truth is an attractor of the dynamic mangling process, objectivity is the insensitivity to initial conditions of the attractor, and significance is the breadth of the basin of attraction.

researcher-centric view he takes: seen from the experimentalist's situated real-time view, an apparatus that mediates access to nature presents itself as a combative "agent" enacting resistive "moves" in response to the researcher's intentional actions to validate proposed theory and concepts. The source of this agency is not any intrinsic intentionality of physical artefacts, but the researcher's situated involvement in the world.[3] Accordingly, Pickering has already extended the concept to cover forms of resistance other than from physical apparatus [1].

The first extension is to resistance that is not primarily from the research object but rather from culturally entrenched notions of proper procedure within the scientist's own disciplinary practices, which he terms "disciplinary agency". The second extension ("cyborg agency") deals with resistance from a socio-technical assemblage (in his case, of numerically controlled machines and their human operators). In each case, it is shown that the "mangle" framework of alternating episodes of human accommodation to resistive agency, progressing towards stabilisation, adequately describes the case dynamics.

We can think of these two extensions as elaborating nuances of a broader concept of "materiality" defined as "that which resists human intentional agency" and which manifests as a "material agency" from the situated, performative view of an actor in a practice. It is this generalised notion of material agency that we will employ when we use the mangle of practice notion to discuss validity for our example case.

4 Example: Researching Information Infrastructuring

In this section we will illustrate how the performative analysis of research validity can be applied in a research project that would raise validity concerns under the representational understanding of science. Our example is a novel research intervention we have pioneered to study the process of industry-wide information infrastructure creation.

4.1 Information Infrastructuring

The study of information systems as information infrastructures is a relatively novel concern among OMS and IS scholars [20, 21]. Increasingly, scholars speak of "infrastructuring" rather than "infrastructure development" to emphasize the processual character of infrastructure creation [22–25]. Our own work [2, 26] has followed this processual turn. We view information infrastructuring as the ongoing becoming of infrastructure as diverse interacting practices become increasingly aligned in their pursuit of a shared enterprise, through on-going sense-making that may disclose new shared uses of information technology. This approach asserts that extension and deepening of the understanding of the possibilities for coordination among diverse practices drives an

[3] Thus he does not see material agency as totally symmetric with human agency, as do some "post-humanists" [18, 19].

uptake of technology, rather than design and adoption of technological artefacts driving greater coordination.

To study infrastructuring we have devised and employed [2] a novel research intervention called a Learning Community. In a Learning Community a diverse group of interested practitioners within an industry meet regularly over an extended period to engage in mutual and expansive learning about each other's practices.[4] The intention is that through such interaction, facilitated by the researcher, participants will come to understand the practices they necessarily depend on for coordinated activity, and consequently gain and diffuse back into their practice a deeper understanding of their own practice – including the potential of information technology as equipment for their practice. According to our hypothesis, this deepening and expanding understanding of interacting practices constitutes the process of infrastructuring. By facilitating and participating in the process, the researcher is well placed to gain an understanding of the infrastructuring process as it occurs. However, this understanding does not take the form of distanced observation: an important aspect of the researcher's role in the Learning Community is to discover by trial and error how to cultivate and nurture the community in such a way that the expansive learning that constitutes infrastructuring actually takes place. Thus in a very real sense, the researcher participates with the practitioners in the very infrastructuring process as it occurs. However, where the practitioners are motivated to enhance knowledge within their own practice by better understanding the practices they need to coordinate with, the researcher's motive is to increase scientific knowledge of the infrastructuring process being facilitated.

While this form of participatory practice research holds out the promise of authentic access to its research "object", it is also open to typical scientistic critiques of its validity, implicitly derived from the representational idiom of science. For example, since infrastructuring is an enacted process rather than an external, existent object how can any account of it claim to be true? Since the researcher sacrifices distance to participate in the process being studied how can an account claim to be objective? If a particular instance is studied how can the account claim to have any level of significance?

4.2 Applying the Mangle to Research on Infrastructuring

To apply the mangle of practice framework here we note that the researcher engages in a time-extended, two-way interaction with the Learning Community, comprising workshops, interviews and other forms of conversation and dialogue. The researcher will put up for review by the Learning Community a certain understanding of information infrastructuring that informs the researcher's interactions at a given time, which may encounter resistance in the form of objections or other negative reactions of the participants. Thus, just as in all other cases of mangling described by Pickering, the researcher

[4] In this paper we will not present results of this research. Here we are using the particular arrangement of this research intervention as an example to which to apply the performative analysis of validity.

will have to iteratively modify and accommodate intentions, understandings, procedures and instruments to a form of "resistance" until an agreement between researcher understanding and the reactions of the Learning Community is achieved. But it is important to recognise that this resistance derives from the understanding that each participant has by virtue of that participant's enrolment in their own particular practice, for instance, understandings within the practice of how work must be done, what are worthy aims and what is appropriate equipment use. Thus we style this kind of resistance as a "practice resistance", which is another form of generalised material resistance and appears to the situated researcher as a material "practice agency", *not to be confused with the human agency of any particular participant*. In fact, this resistance has the same nature and source as the resistance that participants face in their own attempts to adjust their own understanding of adjacent practices in the course of their exposure to these practice in the Learning Community.

This process is quite analogous to how the physical scientist refines his/her understanding of a natural phenomenon by adjusting to how a machine that captures that phenomenon – their apparatus – responds to active "interrogation". In the present example, the phenomenon of infrastructuring is captured in the expanding understanding of the community of interacting practices. So again we can conceptualise research in this example as a time-extended struggle between the researcher's "human agency" and the resistive "practice agency" of the Learning Community as apparatus. This situation is depicted in Fig. 2.

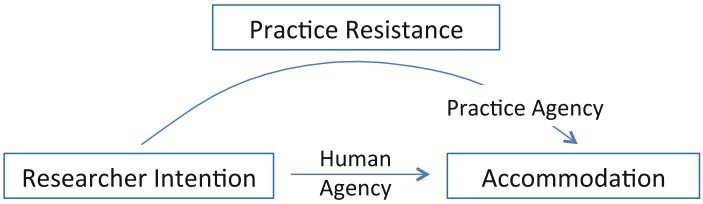

Fig. 2. Researcher's intentions encounter resistance from information infrastructuring practices, resulting iteratively in an accommodation of human and practice agency.

However, the researcher not only faces resistance from the information infrastructuring practices, but also from his/her own research practice. The researcher is expected not only to apply "rigorous" scientific methods in his/her work, but also to extend scientific knowledge by doing sanctioned forms of research. Thus, the researcher must present to the research community new theoretical, empirical or methodological insights derived from the study of information infrastructuring in practice. These may challenge existing forms of knowledge and sanctioned methods, and will thus rouse "disciplinary resistance". The researcher is therefore necessarily involved in an additional mangling with disciplinary agency that must be stabilized if the researcher wants to validly claim to have extended disciplinary knowledge of information infrastructuring. This situation is depicted in Fig. 3.

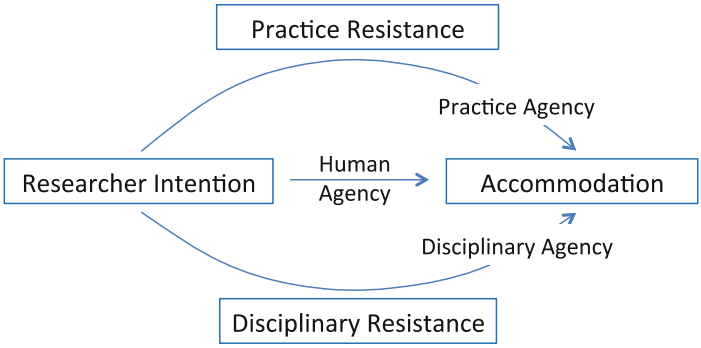

Fig. 3. Research accounts of information infrastructuring practices are an accommodation of human agency with both practice agency and research disciplinary agency.

These two forms of resistance interact with each other since some of the researcher's explanations that have been successfully aligned with the information infrastructuring practices may be resisted by the research practice and vice versa. The barriers to successful accommodation to these two intertwined forms of resistance are therefore quite high. In what follows we will demonstrate that such a call for dual accommodation is justified and, indeed, necessary for science genuinely to do its job in the realm of social phenomena.

4.3 Performative Validity Claims for Research on Information Infrastructuring

We now apply and extend Pickering's analysis of validity within the performative idiom of science to our example case of researching information infrastructuring practices.

Truth: An understanding of information infrastructuring is acquired if, and to the extent that, mangling of the researcher's agency with *both* the agency of the information infrastructuring practices studied *and* disciplinary agency of the researcher's own research practice (Fig. 3) becomes stabilized. Such an understanding will be a hard-won, stabilized but fragile, agreement between researcher explanations and practitioner understandings. The researcher will have repeatedly and stubbornly presented their explanations of "what is going on" to the practitioners *and* within their own discipline to solicit responses. In this process, the researcher will have modified some explanations, dropped others and discovered alternative ones until *both* practice resistance and disciplinary resistance become sufficiently muted to assume that an accommodation has been achieved. The agreement is *fragile* because multiple practices are involved and articulation of that understanding can change the practices themselves. The agreement is *hard-won* because it resulted from the actual human work and acceptance of risk characterized by the mutual mangling process. The researcher will have put on the line their very identity as a social scientist, welcomed practitioners to challenge the researcher's grasp of the nature of their practices, and also accepted the challenge to defend that understanding to peers.

If stabilization is achieved, it can be said that the researcher has "true" knowledge of the information infrastructuring process. It is worth digging deeper into the character of such a "truth claim". First, it cannot be a claim to have uncovered "mechanisms" that operate "behind the backs" of the actors in the practices, which are only recognized because of the special theoretical sensitivity afforded to the researcher by the research discipline. But equally, it is not a claim for special local practical knowledge by a researcher who has "gone native" and obtained tacit knowledge beyond the explicit reach of the discipline. Rather, it is a claim that an extended interaction between multiple parties and practices has created the *ground* upon which an explicit and truthful account of the infrastructuring process could be articulated, agreed upon and shared. On that ground of effortful and risky interaction, a knowledge–reality correspondence has been *performed* rather than passively *observed*.

Objectivity: According to Pickering's analysis, a performative interpretation of objectivity refers to a kind of "washing out" of individual interests, pet theories and normative orientations through the gradual and on-going mangling of human and material agency. Applied to research on information infrastructuring, the focal and the research disciplinary practices will have put up dual resistance to the researcher's intentions and will have forced the researcher to defend or modify theoretical concepts and methodological approaches to the phenomenon through several iterations. As this iterated process goes on, increasingly ideas and concepts will have become detached from their origins to the extent that the researcher can no longer claim to "own" them: nor can practitioners completely. They are now the "public property" of the collaboration. Consequently, these ideas and concepts can no longer be traced to particular interests, motives and preferences that researcher or practitioners might harbour. This process of *freeing* knowledge from individual intentionality is enhanced by the phenomenon studied that involves multiple practices and sources of resistance.

At the same time this new kind of "objectivity claim" can no longer serve to justify normative proposals to "reengineer" the practices to overcome problems, discovered by the researcher through objective causal analysis, that are not apparent to the practitioners themselves. However, it does support a different kind of normativity because the understanding so obtained includes and embeds the vision towards which the practices themselves are already heading and working as part of the becoming of the information infrastructure. Any advice that the researcher (or any practitioner) gives has *already become* at once both relevant and scientific, in a way that a privileged "interventionist" normativity cannot be.

Significance: Above we argued that significance, within a performative idiom, should be associated with the breadth of the interaction that becomes stabilised, rather than with the generality of some theoretical assertion. Such broadening can only be achieved through further mangling. For research on information infrastructuring, two possibilities might be entertained. In the first, styled on the traditional notion of generality, researchers might attempt to involve more practices in their efforts. However, such efforts would quickly become limited by material means and the difficulty of aligning ever more practices. The second is a possibility only revealed within the performative approach. An agreement already achieved with a particular infrastructuring process may be broadened through the mangling that occurs with research disciplinary agency,

resulting in changes of understanding of information infrastructuring processes within the research practice itself. Other researchers, drawing upon this changed disciplinary understanding, may then encounter changed resistance when mangling their own understandings with further independent instances of infrastructuring practice, and so on, in an iterated form of Fig. 3. Consequently, the multiple independent information infrastructuring processes studied by independent researchers will become indirectly involved in a broader mangling process. To the extent that the various understandings brought to this larger mangling process converge and achieve stabilization, the resulting alignment of understandings becomes broader and thus more significant.

Two things should be noted about the character of this performative significance claim. First, this catalytic form of broadened scope depends on the researcher submitting to *both* forms of resistance depicted in Fig. 3. Second, this spreading and alignment of understanding within diverse infrastructures extends the reach of "public knowledge" among the practices, and is therefore *the very process of information infrastructuring itself*! Thus, the significance of research on information infrastructuring is measured by the extent to which the researcher ultimately *contributes* to the phenomenon studied.

5 Discussion and Conclusion

We began this paper by asking "what should be the validity claims (truth, significance, objectivity) for practice-oriented research, where it is neither feasible nor desired to adopt the assumptions that support the correspondence principle of the representational idiom?". Noting that Pickering's performative analysis of validity, developed largely in the context of natural science, does not require any commitment to scientific realism, we applied this analysis to our own context of research on information infrastructuring practices.

The answers we arrive at are both interesting and challenging. The three aspects of validity become quite closely related to each other and also, in a particular sense, to the phenomenon that is studied. A research claim is *true* if a genuine interaction between the researcher and practitioner has created the ground for an understanding shared between their practices; the claim is *objective* if it is not subservient to any party's particular intentions and interests and becomes "public property"; and it is *significant* if it has contributed to extending the reach of the information infrastructuring process. In a deep sense, these are also the requirements of the kind of shared understanding that constitutes the process of information infrastructuring itself. Thus for our example, performing valid research on information infrastructuring is largely indistinguishable from its practice object.

These specific conclusions about validity ultimately derive from our analysis of the *dual resistance* faced by a researcher from both the focal research practices and their own disciplinary practice. This dual resistance was not anticipated in Pickering's discussions of the mangle of practice because his cases (experimental, conceptual and sociotechnical) all still focussed on a researcher/actor studying a world they were not actually part of. However, the context of genuine participatory research motivated by the desire to create widely shared *public* practices by means of infrastructure, brings to the fore

the need for an account of science as an activity of studying a world, or rather disclosing a *new* world [4], that researchers and their research subjects are equally part of. This requires a more symmetrical treatment of scientific and practitioner knowledge production in which valid research is performed by meeting the challenge of this dual resistance and accepting the risk this entails. We argue this is the basis of genuinely engaged and relevant scholarship.

Thus, it is arguable that our conclusions also apply more widely, to a large class of social scientific research where the issue is contributing to public knowledge and broader practice. A reason for believing this is that all practices must of necessity coordinate with other intersecting practices and so all practice knowledge development is essentially infrastructuring. However, defining the class of research interventions to which our specific conclusions apply is for future work.

More broadly, the approach described here can potentially be applied to any research setting to determine specific conditions for research validity. The great advantage of this framework is that it does not require "special pleading" on the part of social science for validity, because the performative idiom is derived from, and already captures, the actual processes of knowledge creation in the natural sciences that are usually held to be the "gold standard" of rigour. An important implication is that research rigour need not be exclusively associated with observational distance. The issue is not for the researcher to retreat to the "high ground" of detached observation of the research object, but to create through effortful interaction with the research object a "middle ground" where a desire to account for the world and the world's resistance to being accounted for, can collaborate in *performing* rigour.

We also note a close relationship of our arguments to Gadamer's [27] conception of "fusion of horizons" (between information infrastructuring practices and the research practice) and to Heidegger's [28] notion of truth as disclosure (*aletheia*) as the condition for the possibility of any knowledge–object correspondence. We leave these theoretical threads to be explored in future work.

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Synthetic Situations in the Internet of Things

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Abstract. The proliferation of distributed digital technologies in contemporary enterprise challenges the understanding of situated action. This paper revisits this notion in the era of Big Data and the Internet of Things. Drawing upon longitudinal studies within the offshore oil and gas industry, we empirically expand upon Knorr Cetina's "synthetic situation" to encompass data-intensive work where people are not co-located with the physical objects and phenomena around which work is organized. By highlighting the performative nature of synthetic situations in the Internet of Things – where phenomena are algorithmically enacted through digital technologies – we elaborate upon the original formulation of synthetic situations by demonstrating that (i) algorithmic phenomena constitute the phenomena under inquiry, rather than standing in for physical referents; (ii) noise is irreducible in algorithmic phenomena; (iii) synthetic situations are productive rather than reductive. Finally, we draw brief methodological implications by proposing to focus on the material enactment of data in practice.

Keywords: Synthetic situation · Performativity · Algorithmic phenomena · Internet of Things

1 Introduction

Few notions in social informatics have been as cherished and influential as that of "situated action" [1]. The notion of situated action underscores the inherent contingencies of how work practices, very much including use of technology, unfold. The notion has been crucial in debunking deterministic influences [2]. That action is situated is accordingly firmly established. What remains unclear, however, is *where*, *how*, and *when* the situation influences action. What, exactly, is a "situation"?

This question is increasingly pressing as modern work practices are growing more information-saturated and dependent on interconnected and interacting heterogeneous information and communication technologies (ICTs) – such as networks of remote sensors, gadgets, and artefacts – going under the banner of the Internet of Things (IoT), generating vast amounts of quantified datasets (Big Data) [3]. The increased prominence of mediated information (sensor data, images, visualizations, algorithm calculations) *transforms* the conditions for work [4], particularly in data-saturated settings such as the

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oil and gas industry [5]. Focusing on how situated actions are shaped through distributed, interacting, and remote technologies, implies a shift of analytical focus towards *performativity*, namely on the way assemblages of tools, concepts, and expectations that we use in order to act on and conceive of objects also shape a situation [6].

The purpose of this paper is therefore to discuss the qualifier "situated" in "situated action". More specifically, we analyse and discuss the performativity of the material aspects of the "situation" in modern, technology-saturated settings. We engage with a stream of research which has debated the under-specification of what goes into the "situation" [7, 8], notably critiquing the understanding of "situation" as overly physical, i.e. too closely tied to the local, physical site [9, 10]. In particular, we build upon Knorr Cetina's notion of synthetic situation, originally developed to theorize situations where people find themselves in one another's presence without needing to be physically co-located [7]. We extend upon her work to also encompass situations where people are not co-located with the physical phenomena their work is organized around, i.e. synthetic situations in the Internet of Things.

We draw upon empirical insights from two studies within the offshore oil and gas industry, a reality where work is conducted by necessity in the midst of a "datafication" [4]. That is, how situated action is laid out and constituted through the material aspects of (sometimes faulty) sensors, data streams, measurement devices, and heterogeneous on-screen representations.

We contribute towards current debates on conceptualizing digital technologies in contemporary work and organizing [11]. While the majority of the notions of situation in the literature are shaped by empirical settings that vary in terms of *distribution*, our notion of situation also varies in terms of *material configuration*. A performative rather than representational approach is a defining feature of the programme on materiality in Information Systems (IS) aiming to understand the ways in which people and technologies, their properties and boundaries, are enacted and reenacted in practice [12]. Our contribution therefore offers a way of exploring how material reality is performed in action through the arrangements for knowing about these phenomena, and how these arrangements are made to endure across space and time [11, 12].

2 Theory

2.1 (Re-)Conceptualizing Situated Action

The fundamental, compelling insight of situated action is that action is not determined by design or constraints. Action is contingent, based on local circumstances and resources. As Suchman [13] expresses in revision to her 1987 book:

> [A]ll activity, even the most analytic, is fundamentally concrete and embodied […] however planned, purposeful actions are inevitably situated actions. By situated actions I mean simply actions taken in the context of the particular, concrete circumstances. [13] (pp. 25–26)

Thus there is a radical indeterminacy of action that effectively undermines overly structural accounts. Viewed in this way, action is situated. Where unclarity, disagreement, and debate start, is when it comes to detailing our understanding of the meaning of

Suchman's "context of the particular, concrete circumstance" [13] (p. 26). Several criticisms have been levelled at this idea, in the recent literature.

An important strand of critique is that Suchman's "particular, concrete circumstance" suggests an overly physical, space–time bounded meaning of the situation.[1] When for instance Orlikowski [2] points out that "every encounter with technology is temporally and contextually provisional, and thus there is, in every use, always the possibility of a different structure being enacted" (p. 412), Kallinikos [9] argues that this forefronts the "here and now" of the users' encounters in front of a computer screen. A space-and-time conflated understanding of "situation" marginalizes to the level of non-existence historical and institutional precursors as:

> the activities that take place at the human-technology interface cover but a limited area of a wider system of instrumental relations, sustained by a huge network of technical, organization, and social arrangements that render the functionality and contextual enactment of a specific technology possible. [9] (p. 237)

Similarly, but with attention to potential biases associated with ethnographic methods, Williams and Pollock [10] identify a "localist sentiment", i.e. a tendency to conceptualize the "situation" as the physical and local site of investigation. In an effort to go beyond "localist" understandings of "situation" that do not fit modern work and organizing, Pollock et al. [8] propose the notion of an "extended situation", where

> aspects once seen as central to localist analysis (co-location, proximity, etc.) are no longer the primary organizing features of [distributed work] as others begin to emerge, but also to show how the "where" of this form of work is now mediated by technology. [8] (p. 255)

Monteiro and Rolland [14] address how dependencies and similarities between distributed work practices emerge. The discretion of situated action is not unbounded – as Orlikowski [2] makes clear, "[s]aying that use is situated and not confined to predefined options does not mean that it is totally open to any and all possibilities" (p. 409). Acknowledging this, Monteiro and Rolland [14] point out that this leaves unaccounted the emergence of standardized (in the sense of similar but not identical) work practices, which they coin "trans-situated".

Thus, the empirical and theoretical understanding of the "situated" needs to be problematized in light of the increasing technology mediation in modern work. Knorr Cetina [7] showcases that the work practices of financial traders are situated with reference to both the individual trading floors and, simultaneously, the technology that facilitates interaction between the different trading floors. She proposes the notion of a "synthetic situation" to conceptualize how a "situation" emerges and is constituted by computer-based projections. In studying the shift in the organization of financial trading from physically co-located to distributed and electronically mediated, she defines synthetic situations as translocal "environments that are augmented and temporalized by (fully or partially) scoped components" [7] (p. 69). The concept of synthetic situation therefore underlines how representations on the screen (numbers, graphs, charts) are

[1] This is not a critique of the concept itself – "situated" clearly was intended to be empirically open by Suchman, in line with her ethnomethodological affinities – but rather to the studies, often ethnographically inspired, that build on the notion.

constitutive elements of the situation of the traders, functioning like a "scoping system", i.e. "an arrangement of hardware, software, and human feeds that together function like a scope" to observe, project, and augment a given reality [7] (p. 64). They are as "real" as physical and social circumstances, but enable traders to reach beyond the physical setting and, in so doing, constitute a reality by stitching together all the aspects that might be relevant to the interaction [7]. The discourse on sociomateriality has recently expanded Knorr Cetina's work by further conceptualizing how the materiality underlying technical and social connections enacts synthetic situations in practice – and therefore aspects of relevance, accountability, and division of labour [11].

In summary, a prominent aspect of the under-specification of the "situation" is the importance of technological mediation (distribution, representations). The role of technological mediation enacted by scoping systems needs to be recast as the intertwining (alternatively: entanglement, mutually constitutive, reciprocal relationship) of the social and the technical (or, more broadly, the material). Despite repeated calls to eliminate the dichotomy between the social and the material [11], however, "the social almost always seems to take precedence, the material merely affording some social/human intention" [12] (p. 816). The slogan "matter matters" [6] is sometimes exactly that, a slogan. As a result, the detailing of *how* – not only that – materiality matters (viz. its performativity) in modern work settings requires further analysis.

2.2 Situating Action in the Internet of Things

Information-saturated "synthetic situations" are not merely representations of sensor-based and otherwise mediated information; they are re-presented. There is an active appropriation and sense-making that goes beyond the passive imaginary of ICT "mediated" information. In contrast with the understanding of ICT mediation that downplays to the level of non-existence the transformative aspects involved in re-presenting, a focus on materiality as performative recognizes that modern "organizations are increasingly depending on such open-ended phenomena as large-scale data capture and dynamic algorithmic evaluation of online activity" [15] (p. 7).

Accordingly, this paper is concerned with situations where encoded, digital objects by necessity play a central role because of the distribution or inaccessibility of the objects of interest (subsea resources, reservoirs, wells) hence difficulty of relying on temporally and spatially bounded work practices. The unfolding of situated action in such settings extends across technological arrangements comprising heterogeneous interconnected remote instrumentation such as sensors, tools, gadgets, and measurement devices (i.e. IoT) generating potentially vast amounts of diverse or "big" data. What the nature of these data heaps entails for work, social, or private life is at the centre of a growing body of research [3], but the literature has mostly focused on the implications of Big Data for business [16].

However, this emerging stream of research has also highlighted the potential of IoT and Big Data in transforming services and reshaping the means and operations through which information becomes available for decision makers in organizations [16], as they have the potential to change the very nature of inquiry. Instead of affording the testing of human-generated hypothesis, smart algorithms are capable of actively asking new

questions [3], thus rendering phenomena visible and knowable in novel ways that are never neutral, but constantly change the relationship among work, knowledge, and authority [17]. The majority of Big Data/IoT research, however, still tends to assume the data to be dematerialized [4], and the rhetoric associated with it conveys a technologically deterministic ideal devoid of the social [18].

Studying the sociomaterial nature of the data in "Big Data" is fundamental to understand how new IoT-inspired technological arrangements are performative in the sense that they do not only address, but also produce new phenomena [19]. "Big [D]ata owes much of its distinctiveness to the mechanisms by which it is generated and the messy or trivial everydayness these mechanisms help install at the heart of the processes of data generation and use" [16] (p. 46). In other words, datasets, the technological arrangements that generate them, and the practices in which they are immersed are co-constituted. We should therefore develop sensitivity to the way different entailments of these algorithmic phenomena play out and under what conditions [15].

This constitutive entanglement [11] has been investigated in synthetic situations where work relies almost entirely on making sense of digital datasets, due to the inherent distribution or inaccessibility of the phenomenon being studied. Østerlie and colleagues [20] for instance showcase how the material phenomena happening in the well flow during oil production (e.g. faulty sensors, sand, oil flow, high pressure) and the phenomenon that is observed (e.g. sand detection) remain undifferentiated until they are materialized in the real-time data as part of everyday epistemic practices to detect sand across the material arrangements of sensors, computing equipment, and algorithms. What these studies point to is that, due to the distance from the physical referents, *algorithmic phenomena are the phenomena* – sometimes triggering a "lure of the virtual" where practices based on virtual models tend to overlap with practices on virtual models [21].

An interesting avenue of research thus consists of demonstrating how algorithmic phenomena play out in synthetic situations. We analyse the synthetic practices of three communities of professionals in the oil and gas offshore sector. We focus on how the representations of the phenomena that they monitor are performed in non-neutral ways through the practices and routines to make sense of the materiality of their imperfect monitoring instruments and algorithms, the digital data they generate, and physical reality.

3 Research Setting and Methods

Our analysis draws upon our joint and individual empirical studies of petroleum professionals' work practices in monitoring operations in all productive phases of offshore oil and gas operations. Offshore operations are an extreme case of synthetic situations as petroleum professionals are increasingly separated from the physical referents of their work practices through on-going efforts to introduce real-time data transfer solutions, increased bandwidth, better instrumentation, software that facilitates remote collaboration combined with relocating key personnel from offshore to onshore facilities. The synthetic realities brought about through these arrangements introduce high degrees of uncertainty, but petroleum professionals have learnt to deal with imperfect re-presentations of the sea and the subsurface. Our shared focus has therefore been to study the

unfolding of the sociomaterial arrangements that the petroleum professionals' work practices are part of.

Two longitudinal ethnographic studies provide our main empirical basis. Parmiggiani has conducted a three-year ethnography of developing approaches for real-time monitoring of marine ecosystems, and Østerlie has conducted a five-year ethnography on digitalization of the offshore petroleum industry. This is supplemented with Monteiro's sustained engagement with standardization of information systems and work practice in the petroleum industry over the past twenty years. Our research was conducted in close collaboration with petroleum companies, offering co-location with different groups of petroleum professionals as well as access to internal meetings together with workshops and seminars with technology vendors and partner companies. A central aspect of our inquiries has been to situate petroleum professionals' work in the broader landscape of technology development, adoption, and use. We therefore also asked people to trace the trajectories of past and ongoing development efforts, and their experiences and reflections about these processes. Table 1 summarizes our main sources of data.

Table 1. Summary of data generation methods

Participatory observations	3 years with R&D division (environmental monitoring)
	4 years with R&D division (reservoir monitoring)
	2.5 years with R&D division (participating in a large-scale digitalization project)
	11 months in an onshore operation centre
	Daily and weekly meetings
	Conferences and seminars related to digitalization in the oil and gas industry
Semi-structured interviews	38 interviews with engineers and environmental advisor involved in environmental monitoring programs
	24 interviews with developers of new digital technologies for operational departments
Document and software analysis	Electronic archives (internal documents and presentations)
	Email discussions and minutes of meetings
	Intranet and internal team sites
	Internet-based public information
	Monitoring software in use or under development

The argument pursued in this paper emerged from our collective deliberations on the empirical material and the way it relates to current debates on digitalization and virtualization. Knorr Cetina's notion of synthetic situations was useful for understanding petroleum professional's work. Like Williams and Pollock [10], however, we also found notions of situatedness problematic as they would limit the study in terms of spatial and temporal framing and of relevant actors. We therefore sought to elaborate upon situatedness by bringing in aspects of the distributed and longitudinal nature of synthetic situations. To this end, we selected three empirical vignettes that intensely manifest the aspects with which we wish to enrich the notion of synthetic situations.

4 Results

4.1 Monitoring the Drilling Activity

NorthOil (a pseudonym) is a Scandinavia-based oil operator, whose Online Centre for Drilling (OCD) monitors in real time all well drilling activities conducted by the service companies hired by NorthOil. The OCD is a large open space situated in NorthOil headquarters. All real-time drilling datasets delivered by the drilling companies are screened in a standardized format on two large monitors next to the main entrance to the OCD and on all engineers' desktop computers. The main goal of the OCD is to monitor the technical quality of the incoming data from all the wells drilled on behalf of NorthOil, to ensure that they respond to the parameters in the contract between NorthOil and the driller, thus guarantee a return of investment for the company. The interface of the system for an external observer largely resembles generic spreadsheet software, where the data records are marked in either green if they lie within acceptable threshold values or red if they do not.

In general, the monitoring practices of the OCD are steered through computer-based in-office projections of worldwide distributed offshore drilling activities. The underlying idea is that specialized engineers should not be out on the rig in order to get access to real-time drilling data. Apparently, then, the scope of the work practices of the OCD spans the screens projecting the drilling data as soon as they become available. Each entry on the screen, however, has to be validated by considering the on-site assessments executed by the professionals on the offshore rig, on the one hand, and the formalized contract signed with the service company, on the other. Especially when a data record is marked red or an alarm goes off, the first thing to do is to understand the source of the problem and solve it as quickly as possible to prevent accidents. Typical errors are missing data, due to, e.g. a failure of one of OCD's streaming tools, the network, the sensors, or the systems used by the service companies on the rig. Some of these errors are, however, invisible to the OCD personnel:

> It could typically be that data is shifted for some reason. [If] the whole dataset … is five meters too deep, or five meters too shallow, [the OCD] wouldn't be able to notice that. Or maybe all of the values are wrong and the service companies are multiplying it by a constant and that's slightly off what it's supposed to be, and that could be due to a calibration error in the sensors. (IT advisor, NorthOil)

Despite the seemingly isolated and aseptic environment in which they operate, the OCD engineers make sense of all data feeds by being constantly in telephone contact with the drilling companies:

> We take the role of error searching and we are typically in dialogue with the service companies 24/7, making sure that the error is fixed. So in many cases we discover the error before the users discover it. But in some occasions we have also [called the offshore personnel], saying "We are in a critical phase, we are missing data, can you please help us error search?" (IT advisor, NorthOil)

As a result, the OCD routines are fundamentally rooted in this dialogue with the remote drillers, because they are often physically co-located with the particular problem that is occurring and have thus a privileged knowledge of the characteristics of a well:

> It's up to the data owners out in the asset, because they know the formation, they know they are supposed to hit this [subsurface rock] layer and so forth, they are fully responsible for the … petro-physical quality of the data. And that requires a human to look at the screens and basically perform that type of checking. (IT advisor, NorthOil)

The situation of well drilling is also shaped by the specific contract that the drilling service company has signed with NorthOil. NorthOil has developed a penalty/bonus mechanism to either penalize or award service companies based on their capacity to provide trustworthy datasets. Penalties or bonuses are directly proportional to NorthOil's key performance indicators (KPIs), thus in turn to the money that a service company earns for drilling each well section.

> [Our system] tells us which component is failing … And we also register downtime … there is actually a direct link between the performance, the KPIs, of the service companies, and the invoices … It gives them a strong incentive to improve their deliverables, and to develop monitoring tools themselves. (IT advisor, NorthOil)

Translating technical data quality into money invites the service companies to monitor their data feeds as efficiently as possible to prevent a loss of money. Some service companies have for instance developed history-matching techniques to understand if the data feed from the drilling activity in one point are correct with reference to the previous feed collected while drilling holes in the same formation:

> And then [some drilling companies] register all [the patterns of the drilling operations conducted in the area by others], and when they start to drill they [visualize] when the current values are very close to historical pattern, and then the alarm goes off you have to inspect. (IT advisor, NorthOil)

4.2 Monitoring for New Oil

Exploring for new oil discoveries, the geology and geophysics (G&G) specialist is at work in front of his computer constructing a digital model of subsurface formations from digital data at Alpha Petroleum Company (APC, a pseudonym). For many, this is a typical example of situated action in the age of computing. The G&G specialist is physically co-located with his computer using an assortment of more or less specialized software for manipulating the data with keyboard and mouse in the here and now. The data this particular G&G specialist is working on, however, stretches far back. These are old data that have already been processed in the past to build models of subsurface geological formations without finding any oil-bearing layers. The G&G specialist is reopening the black box, seeking to discover what was not previously found in the data: geological layers containing oil. The G&G specialist looks for new oil in old data where oil has previously not been present.

Seismic is a key data type in oil and gas exploration. It is generated in complex technical arrangements interacting with the ocean and subsurface formations. A series of long strings (several hundreds of meters) with hydrophones placed at regular intervals are tugged behind a boat moving in a regularized pattern across the area being charted. At set intervals a device drives sound waves into the ocean floor. Subsurface formations reflect these sound waves in different ways, and it is the reflected waves the hydrophones

pick up. Before they can be used to model the underground in search of oil-bearing layers, these sound reflection data come to be entangled with a whole array of different algorithms and work practices filtering out noise and normalizing the data.

Seismics are quite messy. In general, digital sensor data often resonate with many other phenomena than those about which the sensors are designed to generate data. The construction of digital sensors is such that they may register noise, and occurrences in the particular situation when the data are generated will therefore register in the data. With seismic data, this noise needs to be identified and then removed before the data can be used to construct a model of subsurface formations. One of the first things to be done with the data is to correct for drift in the hydrophone setup. Currents and wind can make the lines drift to the left or right, distorting the sound reception. The spacing between the lines, which is important to analysis, can also shift. All this has to be corrected. The company producing the seismic data usually does this correcting, as it requires understanding of how line drift and spacing manifest in the data. Once corrected, it is time to remove noise. There are whole sound spectra that are considered noise, and will be removed by default. Only at this stage are the data ready to be used for constructing models. Things are, of course, never this simple, and prospecting for new oil in seismic data is a constant iteration between cleaning up the data and regressing to messier data to make sense of what is at hand. So when the G&G specialist finally sits down with his or her computer to develop models, any oil-bearing geological structures that appear are very much the product of the long-winded, distributed process of generating and cleaning data.

However, it is this very noise that explorationists are now turning to in their constant quest for undiscovered occurrences of oil. Seeking new oil used to be a matter of finding unexplored areas. But as most territorial areas on the Earth have been explored, oil and gas companies are starting to investigate already explored areas for occurrences of oil that escaped their initial exploration. This, however, requires a lot more than just drilling more exploration wells. Instead, oil and gas companies turn their attention away from the physical world and to the world of digital data, which is the impetuous behind the activities of the G&G specialists above.

"We have a theory", the manager in charge of APC's seismic technology development programme tells us, "a theory that we can use on a range of what has previously been regarded as noise to detect new kinds of oil-bearing formations". He is quite animated, the interview starting in mid-sentence as if picking up on a longstanding conversation. Speaking faster than we are able to follow, he comes across as a mad scientist type – like many of the other explorationists.

APC has set up a whole research programme to find ways to repurpose data noise in an effort to discover oil-bearing layers in areas that have already been explored. APC has recently discovered oil in an area that has previously been explored by other oil companies and found to be barren. The oil was found in structures deeper than previously expected to be oil-bearing. Now they have initiated a project to investigate if this particular oil-bearing structure can be found by including parts of what has previously been regarded as noise in the seismic data. To this end, they have handed the seismic raw data from this field to a company specializing in seismic interpretation to see if they are able to develop an algorithm to bring out this formation in the noise.

The particular analysis software our G&G specialist is working with has been developed as part of this programme. His ability to find oil-bearing layers in the seismic data is contingent upon a broader background of development work.

4.3 Monitoring the Marine Ecosystem

The move of offshore operations into more remote settings such as offshore South America or the Arctic region is accompanied by an increased attention on efficiently monitoring the health of the marine environment. Subsea environmental monitoring was born as a set of disconnected and long-term tasks to collect samples of the water and the marine biomass conducted by third party consultants. Currently, it is evolving towards real-time approaches integrated with other operational phases such as well drilling and petroleum production, based on networks of heterogeneous subsea sensors, cameras, and other devices. The infinite qualities of the marine environment are thus quantified into potentially large amounts of datasets that are sent onshore via fibre-optic or satellite technologies. Given the relative novelty of these approaches, uncertainty still dominates with respect to how these data can be combined and interpreted.

Since the mid-2000s, NorthOil has initiated a promising real-time environmental monitoring system offshore north Scandinavia. The system consisted of a network of subsea sensors to measure water temperature, pressure, salinity, and other oceanographic parameters and a few acoustic devices to track fish and other moving resources. Given the density of cold-water coral structures in the Barents Sea, the main body of the sensor network was then connected to a 2-metre crane equipped with a subsea camera and a flash to take pictures of a nearby coral structure. As a result of the success of this solution with the company's management, in 2009 NorthOil decided to adopt the same concept to a newly acquired functioning oil production field off the coast of Brazil. The seafloor in the vicinity of the Brazilian field is densely populated by calcareous algae, and the Brazilian authorities' concern was that possible leakages caused by oil production might prevent the light from reaching these plants to enhance their photosynthetic process.

A set of sensors similar to those installed in the Barents Sea was set out to monitor the underwater environment around the operational field with the purpose of looking at possible oil leakages. The environmental experts at NorthOil soon discovered that the materiality of calcareous algae and that of the corals makes these creatures very different: completely different technological and analytical configurations were needed to perform them into an oil and gas operational context. First, whereas algae are plants, corals are animals and do not need as much light to grow, so the sensors developed to monitor their health did not take the light into account as a primary factor. In addition, the Arctic sensor network had been designed to monitor corals which can build structures of up to 20 m. In contrast, calcareous algae are the size of a golf ball. In the Brazilian field there was therefore no need to install a satellite crane to position the camera, which could thus take pictures of the algae directly from the sea floor. The unsuitability of the sensors was accompanied by a series of unexpected electronic failures:

> [W]e got a little damage on it so it registered data only for a short period, and then the batteries ran out, really a short circuit … One part of the reason was that we went out of energy, another was that the sensors did not work as they should have then, so there was a deal of problems with

> corrosion and short circuits because the environment in [Brazil] is extremely corrosive. We had not taken that into account. (Environmental advisor, NorthOil)

The situation in Brazil was thus heavily shaped by its natural characteristics; the Brazilian waters are very different from the Norwegian waters, they are warmer, more saline, and currents are stronger, meaning that the Brazilian marine ecosystem is more corrosive than NorthOil environmental experts initially expected. Failing to take this aspect into account caused a number of technical failures that did not allow the program to gather sufficiently good data streams. As a countermeasure, the support structure was rebuilt in titanium and designed such that all sensors were much more protected from the water current.

Eventually, the data collection was carried out successfully. The internal analysis of what went wrong during the first monitoring rounds turned the company's attention to a phenomenon they were not looking for originally, namely damages caused by the corrosive effects of the water on the nearby oil platform that would have otherwise remained unnoticed and caused serious accidents:

> It came as a big surprise for the whole organisation, so we have conducted massive reinforcements or measures in relation to the platform which stands there. It's a little stupid if the platform suddenly disappears! (Environmental advisor, NorthOil)

Environmental monitoring strongly relates to safety in the Brazilian case. Given that the planning of the platform had been done by another company, it also emphasized the importance of carefully weaving environmental monitoring practices to the company's business choices:

> [It is a] typical example that […] shows a very special example of the extreme need to have good meteorological and oceanographic data before you go in. One thing is in a way the environmental measurements, but in relation to the safety part, it is totally essential. (Environmental advisor, NorthOil)

5 Discussion

Our three empirical vignettes resonate with the concept of synthetic situation, defined as informational projected "others" with which humans interact and which evolve over time [7]. Oil and gas professionals necessarily rely on evolving digitalized forms of knowing such as simulations and real-time computerized analysis to interpret events they cannot access directly. In the case of reservoir monitoring, knowledge about the presence of oil develops along a temporal dimension as data analysis is a process distributed in time and space through the seismic data and the software used. The G&G specialists' activities for using seismic data to assemble a model of the underground are therefore shaped by contingencies that evolve over time and stretch beyond the specifics of particular computer or software in use.

Moreover, the phenomena under investigation (the presence of oil, the drilling activity, environmental risk) are algorithmic, namely enacted through digital technologies. However, the performative nature of synthetic situations – i.e. the extent to which they constitute the object of enquiry by enacting relationships in practice [6] – in

technology-saturated settings such as oil and gas offshore operations remains underdeveloped. We elaborate upon the performativity of synthetic situations in three ways.

First, in our empirical cases *algorithmic phenomena are the phenomena*, rather than standing in for the physical referents. The discovery of new trends and latent patterns (viz. new phenomena) without well-formed hypotheses or models is a promise of Big Data analytics [4], but the way the data are caught up in the material means of their production is understudied in that literature [4]. The G&G personnel, by re-interpreting the old datasets, are able to discover new trends and patterns to understand if oil is present. Similarly, the environmental advisors conducting environmental monitoring in Brazil are able to make sense of a phenomenon they were not originally looking for, i.e. potential environmental harm caused by the corrosive effect of the water on the oil platform. These situations are, thus, beyond synthetic, in the sense that they are algorithmic, i.e. entirely dependent on the tuning of sociomaterial arrangements of the monitoring systems [15]: the presence of an oil-bearing layer in the seismic data and the corrosive effect of the Brazilian waters are never independent of the digital data processing algorithms.

Second, noise is *irreducible in algorithmic phenomena*. Big Data techniques as synthetic situations are often intended as ways to cope with exceeding amounts of information by being able to filter out the noise. In our study, however, it is never possible to filter out the noise, because, as the world is constantly enacted and re-enacted through material-discursive practices [15], the noise becomes the source of new knowledge. In this process, oil and gas professionals engage with the "dual materiality" of phenomena [20]: they go constantly beyond the screen to worry about data quality, sensor reliability, i.e. the material circumstances of the data that make up their synthetic situation. This also differs from Knorr Cetina's example of a scoping system [7], where traders are able to successfully filter out the noise without systematically going beyond the screen. In contrast, the monitoring activities in oil and gas offshore operations involve the material circumstances of data processing (algorithms, simulations, and analysis tools), as well as the material circumstances of data production.

This foregrounds a third way in which our study extends Knorr Cetina's concept: the synthetic situation is *productive rather than reductive*. What originally looks like noise that must be reduced is in fact a new situation. Zuboff [18] for example shows how Google managed to create enormous revenues by turning apparent noise generated by Internet users into a marketable asset for commercial and surveillance purposes. Similarly, the process of re-processing the old datasets from oil exploration showcases that the situation for the G&G personnel is actually constituted by what was originally considered noise. This, too, proves to have business value for APC. At the OCD, drilling monitoring unfolds in a synthetic situation that looks like that of the traders described by Knorr Cetina [7]: the OCD personnel must rely on on-screen projections to make sense of a remote reality. Nevertheless, the apparent noise – namely the overhead of work to call and talk to the offshore engineers – turns out to be a pivotal part of their synthetic situation, which therefore extends behind the screen to encompass the informal machinery of sense-making enacted by the offshore personnel in communication with the OCD. The synthetic situation of the OCD is also further extended on the formal level, by tying the sense-making practices (which the OCD personnel know unfold informally)

to contractual clauses and KPIs. Finally, also environmental harm offshore Brazil emerged out of the noise, namely the bad quality data obtained as a result of short circuits and damages to the monitoring station, and the associated workarounds to repair it. In this case, the situation encompasses also the (apparently mundane) interactions of social and technical elements with the materiality of nature to make sense of natural phenomena with good enough approximation.

6 Conclusions

Our paper takes steps towards conducting interpretive studies of knowing in the era of Big Data and the IoT – namely through synthetic situations characterized by physical inaccessibility (such as the energy industry and space exploration) and virtualization (such as the car industry [21]). Our analysis has also methodological implications, as the variety and uncertainty of the data involved challenge the dynamics of traditional qualitative research bounded in space and time. Focusing on the productivity of algorithmic phenomena implies a *shift of focus from the actors' meanings to include what sociomaterial assemblages "do" in practice* [6]. We accordingly supplemented our interpretivist method by scaling access and capture the longitudinal and distributed nature of both the development and use of digital enterprise technology [10]. We in other words investigated the way datasets "travel", namely how an interpretation is performed together with the materiality of both the physical reality and the algorithms behind the evidence that makes it the right interpretation. This perspective on the quantification of quality recognizes that algorithms are performative of categories (e.g. what is noise) and ultimately have political implications in terms of legitimizing human actions [22] and shifting knowledge/power relations [17].

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A Developmental Perspective to Studying Objects in Robotic Surgery

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Abstract. Drawing on interventionist activity theoretical approaches, this paper describes a method of self-confrontation as a way in which to study objects in technology-mediated practices. In addition to research interests, the aim of examining the objects is to develop the capacity of professionals and organizations to work and learn better in complex technology-mediated work. The method was applied in robotic surgery, in which instruments are tele-operated by a surgeon. The robot offers better, collective visualization of the area under surgical operation than previous techniques. In particular, the paper shows how objects were revealed and new objects emerged during the intervention. We suggest that activity theoretical developmental interventions such as self-confrontations may help understand the complexity and evolution of objects, and thus contribute to studies of technology and organizations.

Keywords: Developmental intervention research · Object · Robotic surgery · Activity theory · Self-confrontation

1 Introduction: The Developmental Perspective

The focus of sociomaterial assemblages is on agencies such as actors and objects, which have saturated each other so thoroughly that previously taken-for-granted boundaries have now dissolved [1]. According to a relational ontology, entities – whether human or technological – have no inherent properties; they acquire their form, attributes and capabilities through their interpenetration. The notion of "sociomaterial" attempts to signal this ontological fusion [1] (p. 456). Similarly, Annemarie Mol [2], in discussing the way out of the dichotomy between the knowing subject and the objects-that-are-known, suggests spreading "the activity of knowing widely over tables, knives, records, microscopes, or other things of habits in which it is embedded" [2] (p. 50). Instead of subjects knowing objects, we may come to talk about enacting reality in practice [2].

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The view that objects are enacted in practice, for Mol, suggests that something is enacted only there and then, in the act. Although activities take place, the actors remain vague [2].

Sociomaterial assemblages are important in their consideration of humans and other living entities such as technologies and other materials, and have many advantages in terms of science and policy. The concept of sociomaterial assemblages implies that concrete practices or activities are important in the assemblages enactment (or becoming). However, we argue that we must not lose sight of the human in these practices: first, because even the naming and meaning of a practice, or any entity, are human endeavours: a building may be a hospital to us, but not necessarily so to a fly on the wall. Second, because most changes through time are triggered and driven by the human actors in or outside the systems under study at a given historical time. Although it is important to acknowledge the distributed nature of agency involved in sociomaterial assemblages, it may also be useful and interesting to study them precisely from the human perspective. To investigate sociomaterial practices as dynamic and evolving interpretations of humans in these practices does not necessarily mean a return to an individualist stance of agency. Nor does it lead to denial of the material world. On the contrary, it may lead to the transformation of the sociomaterial assemblages at stake.

Our suggestion for a research encounter with technology and organization is developmental interventionist research, based on a dialectical ontology. We refer to an article by Charles Tolman [3], which contrasts dialectics with the metaphysics of properties and the metaphysics of relations. According to Hegel's dialectical thought, things do not pre-exist, and cannot be independently conceived of their relations with other things [3]. This is similar to relational ontology [1], which dissolves the analytical boundaries between technologies and humans. However, dialectics proposes more than this: it advocates seeing temporal movement as part of interconnections and relations [3]. It is thus interested in change, development and the "becoming" of both human and non-human entities. For dialectics, a concrete understanding of a thing is an understanding of it in its interconnections and dynamic movements. Movement and change is reality itself [4].

Developmental intervention is defined as a purposeful action by an agent to create change [5]. Kurt Lewin, already in 1947, advocated harnessing science in the service of intervention rather than observation [5]. Practices are bombarded with both deliberate and incidental interventions, also without research [6]. Within a developmental intervention, the focus at least partly shifts from discovering how things are to exploring how things may evolve. The interventionist approach focuses not only on how researchers interpret the object of study, but also on how research intervenes in practices in which objects and entities are enacted [7–9]. Because it supports professionals' new interpretations and object formations, interventionist research is, we believe, a possible way in which to renew our understanding of technologies in organizations. In addition to practical outcomes, interventionist research can advance theories (see e.g. [10, 11]).

In this paper, we describe, quite practically, the method of self-confrontations in the Activity Clinic approach, as elaborated by a French cultural historical psychology group [12, 13], and based on a dialogical interpretation of the indirect methodology of L.S. Vygotsky [14–17]. The assumption is that this method helps understand and enhance an interpretive way of working [18, 19], which is needed in increasingly complex,

technology-mediated and uncertain work activities. The second author of this paper is a member of the community of the Activity Clinic, whereas the first author has worked extensively with another activity theoretical approach, namely Developmental Work Research [20, 21]. These approaches look at technology and organization from the perspective of activities [22], and they share a similar concept of the object [23] to that which we apply in our study.

In this paper we will describe, first, how the method of self-confrontations was used in a study of robotic surgery. Secondly, we will identify the different kinds of objects that were present and that emerged in the three-step process of the intervention, by analysing a situational action in robotic surgery. Before presenting the method and the empirical analysis, we will take a look at robotic surgery.

2 The Robot in Surgery

Technological advances in optics, digital video equipment, computers and robotics have opened up new possibilities in surgery. Robotic-assisted surgery is the most recent such advancement. One device, called the da Vinci Surgical System (Intuitive Surgical® Inc.), first introduced in 2000, has become significant in the field of urology. By sophisticated technology at the tips of robotic instruments, a surgeon can operate on the human body with the facility of a human wrist. As in laparoscopy, the operation is performed via tubes (trocars) inserted into the patient through small incisions. This "minimally invasive" technique is different from open surgery, which requires a longer incision. In robotic surgery, the instruments are teleoperated by a surgeon, using a separate console that provides a 3D-vision stereo view [24]. Properties such as tremor abolition, motion scaling and 3D vision can substantially improve the dexterity of the operation, especially in suturing within the patient's body [25]. Compared to open surgery, robotic surgery is more beneficial in terms of shorter hospital stays, decreased blood loss, fewer complications, decreased pain and better outcomes for patients [26].

Our empirical data are about radical prostatectomy, a surgical operation in which a cancerous prostate gland is removed entirely. Although surgery is the primary treatment choice for localized prostate cancer, other treatment modalities also exist. The rationality of surgery depends on the patient's general condition, the type and extensiveness of the cancer, and the patient's expectations and preferences. The patient needs to know the potential benefits and risks of surgery compared to other treatments before making a decision. When surgical treatment is correctly chosen and the patient is well informed, the results of the therapy are excellent.

The main objective of this robotic surgery operation is to remove the cancerous prostate gland from the patient's body. We can divide the procedure into three phases: (a) exposure, (b) dissection of the prostate, and (c) sewing anastomosis, which means reconnecting the urethra and the urinary bladder (Fig. 1). Exposure of the prostate is unavoidable, because the gland is located deep in the male pelvis and is not visible at the beginning of the operation. The most challenging phase is the dissection of the prostate. The surgeon must be careful not to damage important adjacent structures, such as erectile nerves, the neck of the urinary bladder, the muscles affecting urinary continence,

and the rectum. However, if the surgeon dissects the prostate too near the prostate surface, there is a risk that some cancer may remain. The correct dissection plane is estimated by preoperative studies, such as blood tests, radiological images and prostate biopsies. The functional and oncological outcomes are measured at follow-up visits.

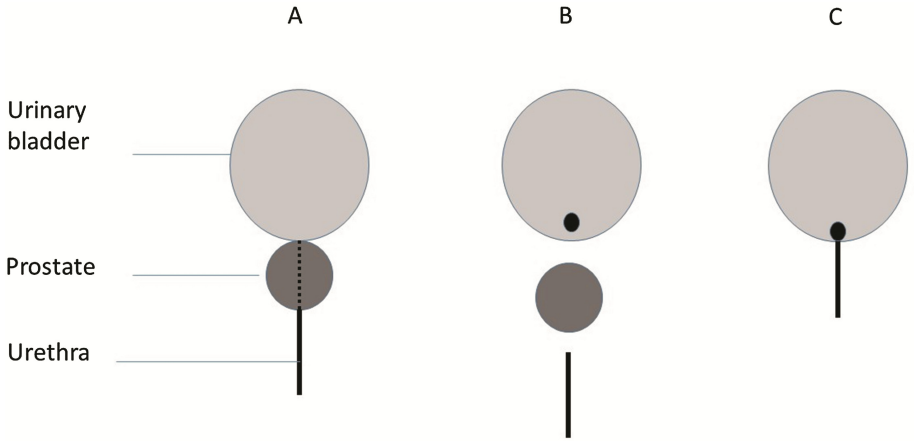

Fig. 1. A rough sketch of the radical prostatectomy. (A) Original location of the urinary bladder, the prostate and the urethra that goes from the bladder through the prostate. (B) In the operation, the prostate is separated and removed. (C) The urethra is reconnected to the urinary bladder (Simplified from [27])

The operative team often consists of two surgeons, two assisting nurses, an anaesthesiologist and an anaesthesia nurse (Fig. 2). The whole team mediates the control of the robot and the surgical operation [28]. The robot also changes the quality of communication, as it inhibits face-to-face interaction, thus reducing the ability to anticipate without explicit demands [29]. This is different to conventional laparoscopy.

Most importantly, robots offer better visualization than other technologies [26]. All members of the team in the operation room see the operation on-line, and can anticipate forthcoming tasks. In contrast to open surgery, surgeons need to see or induce visual indicators to guide their operation, because there is no tactile (haptic) feedback from the robotic device. This may be one of the biggest challenges as compared to open surgery. Therefore, the surgeons and the operating room team need to create and constantly maintain a good visual view by, for example, positioning the camera correctly and keeping the lens clean. The acts of pulling, poking and pushing play a significant role in tissue identification via the visual sense [30]. With extensive experience, surgeons can develop a combined sense, sometimes called "visual haptics" [31].

As the robotic system, and especially the camera, transforms the activities of the surgeons and nurses, it may also induce opportunities for learning and developing. The operations are routinely video-recorded, which means they can later be watched, evaluated and reflected upon. Robotic surgery videos are already being used in the global community of surgeons in scientific conferences and medical journals, and in the training programmes of the company of the robotic surgical device. Operating manner and skill

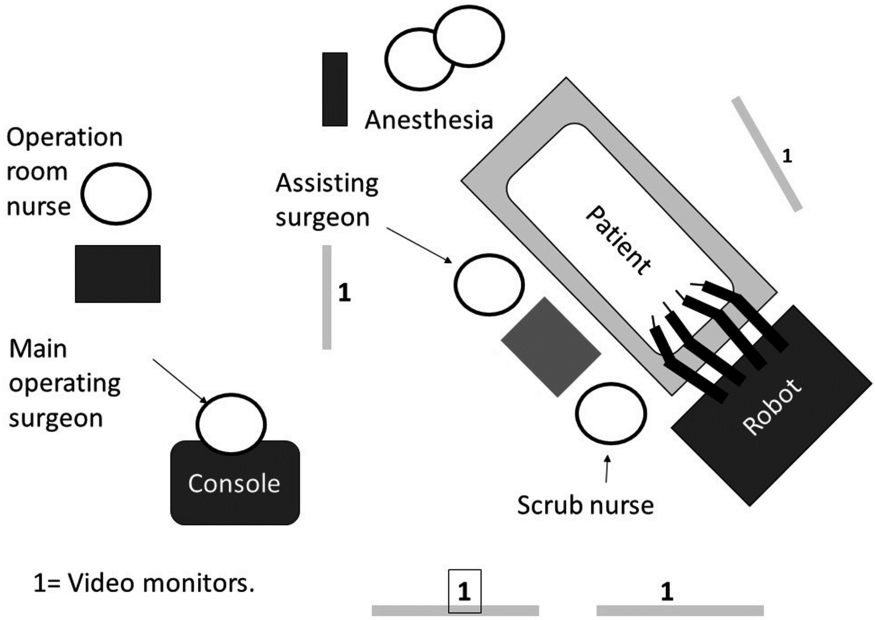

Fig. 2. Sketch of operation room setting during robotic-assisted surgery of prostate. One robotic arm transmits camera view from inside body on-line to console and to four video monitors (1).

is sometimes described as a surgeons' own handwriting, and this can be seen in the videos. Next, we turn to the developmental method used in the research on this surgical activity.

3 The Developmental Interventionist Method and the Concept of Object

This paper is part of a research project that investigates interpretive practice as a promising mode of action for coping with dynamism, complexity and uncertainty at work. Studies of nuclear power plant operations carried out by Leena Norros and Paula Savioja found that even in this highly regulated and proceduralized work, the operators' actual work practices vary considerably [18, 19]. The behaviours that reflected the operators' own interpretation of a situation; questioning the observed phenomena, dialoguing within the team, anticipating the system state, and using various information sources, were labelled "interpretive practice" [18]. This paper's exploratory investigation of objects aims to support the study of interpretive practice. Moreover, we hope to contribute to the research project's aim of outlining a method for enhancing the interpretive way of working in robotic surgery.

If interpretive practices – as continuous learning that makes new connections between phenomena – are increasingly needed in work, we need dialogic methods to support the learning of this way of working. We consider that a method from the Activity

Clinic called self-confrontations is suitable for this purpose. This method follows two principles. First, the principle of indirect methodologies [14–16] suggests that "it is necessary to transform in order to understand, because activity does not allow its enigmas to be resolved until it is put into movement" [12] (p. 287). Second, the law of the double source of development states that new functions first appear on an interpersonal plane before appearing on an intrapersonal plane [17]. This methodology therefore relies on processes of objectivation and subjectivation, in which the subjects develop new ways of looking at their work activity through engagement in a dialogical process with the researchers, with their peers and with traces (here, video recordings) of their work activity. The change of addressees, that is, the participants to whom talk is directed, is a way in which to enhance dialogue and the emergence of new objects. By being dialogical and interested in increasing understanding and effecting change, the Activity Clinic can help phronesis, enhancing a socially relevant form of knowledge [32].

Although human perspective remains central in our study, its nature depends on the material and social practices in which it is involved, and the mediational tools used by the agent [33]. In activity theories, human conduct is seen as activities that are oriented towards social and material objects in the world, and mediated by signs and tools [34]. Objects are sources of motivation and sociality. Considering the activity of robotic surgery as far as it is analysed in our research, we distinguish between primary and secondary objects (Table 1).

Table 1. Types of object used in the study

Objects	Description	Example
Primary objects – related to the work activity		
O1	Main social object of the activity of robotic surgery	Removing cancerous prostate of patient
O2	Material objects of the work environment	Surgical tools, body of patient
O3	Psychological object, situated leading motive of the human agent organizing one's action	Operating quickly and smoothly; saving bladder neck
Secondary objects – related to the dialogic activity in the intervention process		
O4	Object of the research, constructed and partially shared by the researchers and the professionals	Analysing robotic surgery in order to understand and support interpretive practice
O5	Object of dialogue, linguistic object whose appearance and development can be traced in transcripts	Cutting or not cutting?
O6	Object of thinking, psychological object on which the professionals reflect	Best way to proceed in this and future similar cases

The primary object types concern objects of the concrete work activity under examination in the intervention. The first type, O1, includes the main objects of the work activity. These are socially shared objects, the motive around which the whole activity system is designed, such as, in our case, removing the cancerous prostate of the patient. The second type, O2, are the material objects of the work environment. These are external, physical and symbolic objects, including technical tools for mediating the work activity and the target, and the application point of the work activity. For example, the surgical tools, the robot and the body of the patient are of the O2 type. The O3-type object is a psychological object, a leading motive of the human agent at a given time in a specific situation, and organizes actions.

The types of secondary objects are related to the research activity, and more precisely, to the dialogic activity in the intervention process. The fourth type of object, O4, is the object of the research as constructed and partially shared by the researchers and the professionals. In this research project, this type of object is understanding the phenomenon of interpretive practice more deeply, and outlining a method for enhancing it. The fifth type, O5, is the object of dialogue. In Sitri's sense [35] these objects are linguistic objects that allow us to understand what interlocutory partners are discussing, as it becomes discernible in the self-confrontation transcripts. The final type, O6, are objects of thinking, which are the psychological objects that the participants reflect on and argue about.

In the self-confrontation encounters, the main O1 objects are generally obvious and shared by the professionals, and have been mentioned to the researchers during earlier phases of the intervention. The material O2 objects are represented through the video-recording of the work activity and might be picked up by the participants in their dialogues for further discussion. The organizing O3 objects are not directly apparent in the video-recordings, nor directly expressed in the protocols of the work activity, but may appear in the dialogues. The O4 object is also generally implicit, defining the framing of the intervention encounters which has been negotiated earlier and which may or may not be remembered in the dialogues. The O5 objects of dialogue must be reconstructed through an analysis of the transcribed dialogues. The O6 objects are implicit, and not always present. But when they are, they might be reconstructed from the development of the dialogue, or from the architecture of the whole conversation as in a case of controversies [36].

Our categorization above is inspired by the concept of "object of activity" of A.N. Leont'ev [23] in the cultural-historical activity theory. For Leont'ev, an object is something both given and imagined, projected or constructed. The given nature of objects mean that they have independent existence outside human perception and action. In the imagined or constructed capacity, an object gains a motivating force that gives shape and direction to human activities and defines the horizon of its possibilities. This view suggests, from the activity perspective, an intimate connection between concrete material and psychological, socio-cultural objects. Next, we will take a look at the methodical process of self-confrontations in robotic surgery.

4 Self-confrontation Process

Simple Self-confrontation. The first phase in this developmental intervention, simple self-confrontation, means that the professional – in this case a surgeon – together with the researcher-interventionist, watched a series of short sequences of video-recorded material of their activities. The video excerpts were selected by the researchers, based on the surgeons' suggestions on important and challenging operation phases. These phases were difficult for surgeons who were learning the robotic technique, and more routine for the experienced senior surgeons. The researchers had observed all the surgical operations that formed the chosen video excerpts. Prior to the self-confrontations, the researchers had also interviewed the surgeons, who were from various hospitals and had read urological material about the robotic-assisted prostatectomy.

The researchers asked the surgeons to describe as precisely as possible the gestures and actions that were observable in the video, and tried to support their questioning of what they see themselves doing in the video. Explaining one's actions to a researcher from outside the medical and surgical domain, as was the case in simple self-confrontations, prompts professionals to articulate their intentions and actions in different phases, according to what is visible on the video-recordings. This is intended to help the professionals work in an interpretive way, by forming new relationships between the objects, their actions and multiple other issues in their work [37]. The simple self-confrontation was carried out separately on two surgeons who were already experienced in robotic techniques, and two other qualified surgeons, who were learning to operate using the robot.

In addition to watching the video excerpts, the surgeons were asked in advance to bring with them the current case histories of the patients undergoing the operations in the videos. Due to practical reasons, the time interval between the initial surgical operation (in the chosen video excerpts) and the simple self-confrontation was sufficient so that in most cases, the pathologic results (regarding the removal of the cancer as the main object) and some information about post-operative complications and the functional outcomes of the operation (at least urinary continence) were already available. The case histories added a temporal dimension to the self-confrontations and thus changed their quality. Patients' case histories were present in all three phases of the intervention process.

Crossed Self-confrontation. Later, encounters were organized between a researcher and two surgeons who had both previously participated in a simple self-confrontation. In this crossed self-confrontation, the video sequences in which each of the surgeons was the main operator at the console, were watched together. The actions of the same surgeon were again shown on the same video excerpt. The researcher asked the surgeons to comment on the actions of their colleague, on their own actions, and to share their opinions and questions. The purpose of this phase was to create a dialogue regarding different ways of acting. The professionals now needed to address their speech to both the researcher and their colleague. The aim of this "double addressing" was to help the professionals further change their way of looking at the actions in the video. Earlier

work from the Activity Clinic perspective has found that repetition and change of addressee plays a critical role in elaboration [34].

Workshop. In the third phase, all four surgeons, together with the researchers, gathered for a workshop to discuss the findings of the project so far. During the workshop, they watched selected video excerpts to discuss the variety of practices that were revealed during simple and crossed self-confrontations.

All six self-confrontations and the workshop were video-recorded, and the discussions were transcribed for analysis. Later, in this still ongoing project, a joint workshop with the surgeons and the competence developers of the hospital will be held, in order to discuss and generalize the organizational guidance practices. Below, we demonstrate the intervention process with an account of the self-confrontation process. We also raise and interpret, in a preliminary and exploratory way, the different objects revealed in the data.

5 An Extra Hole in the Urinary Bladder

Our empirical case is about a situated action detail in an operation phase during which the prostate is released from its contact with the urinary bladder (Fig. 1, phase B). The case was selected because this phase is generally challenging, has an interesting variation, and exemplifies the surgeons' reflective dialogue throughout the process. The robot has significantly changed the technique of this phase from that of open surgery.[1] In this particular operation, the installing of the catheter was much more difficult than usual, due to a stricture of the urethra. The patient needed another operation, an incision of the stricture, before the catheter could be installed. Therefore, the beginning of the surgical operation using the robot was delayed by about 45 min.

A video excerpt of Surgeon 1 operating the bladder neck area was first watched in a simple self-confrontation between the researcher and Surgeon 1. As well as the biological tissues and structures around the bladder neck, the video excerpt shows the instruments of burning and cutting as teleoperated by the main surgeon, and the suction, traction and transporting instruments handled by the assisting surgeon. It also shows how the catheter controlled by the nurse is used for identifying the transition space between bladder neck and prostate.

Excerpt 1 (from Surgeon 1's simple self-confrontation)

S1: [watching the video, 15 s] You can see that it's [bladder neck] open, on the bladder side, open more than necessary, but this isn't a problem. It's easy to sew, even if it was 5 cm here, even that could be sewn, it's not a problem. But you don't have to sew

[1] With the robot, the bladder neck transection is the first step in releasing the prostate gland, while in open surgery it is the last phase. In open surgery, the right place for the transection can be tactilely felt by the fingers, whereas in the robotic technique, the challenge lies in identifying the right place for the transection on the basis of mere visual cues; those either already existing, or those induced by the surgeons or nurse.

it, but when you sew it now, it makes anastomosis easier. We try to keep the bladder neck as small as possible.
R1: Would there be an alternative?
S1: If you just leave it like that, and there's the small isthmus, you would just cut that isthmus and then, when you do the anastomosis, you would just patch it up, because then you have to join two things, a tube of this size and another of this size, and then you just patch up and patch up here, so in this way (inaudible).

Figure 3 shows the part of the video discussed in this situation. Only a narrow isthmus separated the extra hole from the bladder neck where the urethra was already partly cut.

Fig. 3. An extra hole (left) when separating the prostate from the urinary bladder

Some of the objects, such as those of the organizing O3 type, can be interpreted through the way in which the surgeons express the reasons or justifications for their actions and choices. First, Surgeon 1 claimed that the object and purpose for his decision to repair the extra hole in this phase was *easier anastomosis*. Another object expressed by Surgeon 1 was to "keep the bladder neck narrow" which in other instances is also called *saving the bladder neck*. These are not activity-level O1-type objects (such as the removal of the cancer here) in Leont'ev's terms. As they are projected "downwards", and thus direct the practices of the operation, we call them O3-type objects – objects that manifest themselves in the actions of individual surgeons, and become articulated by them. The psychological activity of the surgeon is directed towards the body of the patient, and mediated by the technical instruments, including the robot.

The same video excerpt was watched again in the crossed self-confrontation between two surgeons.

Excerpt 2a (from crossed self-confrontation between Surgeons 1 and 2)

R1: S1, can you tell us about the hole?

S1: Yes, it [the hole] is here on the left, it goes to the bladder side. Here from the bladder neck. I reflect for a while about what to do here, to cut the isthmus or, to put some sutures (–) It's just a small hole and…
S2: You cut.
S1: No, I (–).
S2: Really?
S1: Yes.
S2: I see. I would have cut.
S1: You would have cut?
S2: I would have cut.

Here, Surgeon 1 observes his small reflection. It is visible in the video as a three-second pause without moving the robotic instruments. Seeing the video excerpt prompts Surgeon 1 to explain the pause to his colleague, because, as we interpret, it is an exception to the normal pace. This explanation can be due to an implicit O3 organizing object, *operating quickly and smoothly*. He accounts not only for the object of the hole and the urethra, but importantly, also turns his own actions, by explaining his "*putting some sutures*", into an O5-type object of dialogue. Surgeon 2 is spontaneously surprised by his colleague's action, and openly expresses this. The fact that Surgeon 1 turns his actions into an object of joint discussion and reflection, and that Surgeon 2 expresses a different opinion on the best way to proceed, suggests that the dialogical framework is working; encompassing trust, freedom of expression, shared interest in investigating the activity and balance of power. This excerpt shows variety in the actions of the surgeons.

Excerpt 2b (from crossed self-confrontation between Surgeons 1 and 2)

R1: Interesting, how did you end up sewing?
S1: Well, I mainly thought that there's a nice isthmus anyway and it's open from there, the bladder neck, in the right place. So I thought let's close the wrong place, so it went as was planned.

Now, Surgeon 1 expresses another O3-type of object: *a return to the initial plan*. We interpret that this object aims at restoring the patient "form" to the normal state: in contrast to the norm, the hole was a deviation from the kind of incision that is typically inflicted on the patient, and therefore sewing would restore normality. The plan here may refer to two things: the standardized process or protocol followed globally in the robotic surgery to remove the cancerous prostate [34], or the plan made for each individual patient. As regards the former, according to our interviews, following a standardized protocol is even more important in robotic than in open surgery.[2] This is curious, as (or maybe because!) the robotic device extends surgeons' visual and dexterity capabilities. Regarding the latter, the individual plan is about the concrete aims in each operation. It is indeed possible that the disturbance in installing the catheter and the subsequent delay in starting the surgical operation strengthened this object, i.e. the surgeon's motive to return to the initial plan.

[2] A strong standard does not diminish the importance or possibility of variation and flexibility [19].

Excerpt 2c (from crossed self-confrontation between Surgeons 1 and 2)

R1: Yes. And S2 how do you justify this?
S2: It's so close to the bladder neck that I would have cut it and then sewn it, as normal, as part of the anastomosis there. It wouldn't have been so big, you could've saved the bladder neck quite easily from the right side. It [the bladder neck] would not have become very big.
S1: No, I guess not.

In this excerpt, Surgeon 2 interestingly justifies his alternative action with the same object of saving the bladder neck. This shows that it is a collectively shared object. The actions are different, but the object is common. This is a very interesting outcome of crossed self-confrontation, which allows the researchers to understand which shared objects of the O3 type are present at a given time in the situation, and how they are influenced by the technology.

The same video clip (Fig. 3) was discussed again in a workshop of four surgeons involved in self-confrontations.

Excerpt 3 (from the collective workshop of four surgeons)

R2: [showing again the same video excerpt as in Excerpts 1 and 2 above]. Does this raise any comments or thoughts?
S2: Double opening done, in a handy way (laughing)
S1: Yes, I can personally admit that there I contemplated, is it a good idea to leave that isthmus there.
S4: – because you cut there
S1: Mm. To cut or to close it there, is it really a good idea to close that small hole.
R2: What are the alternatives?
S1: If you cut, the bladder neck remains bigger, you need to stich more up later. What would you have done? S2 shows (–) commented last time that (–) S4, would you cut that track?
S4: I don't know if it makes any sense to keep it. It's burnt, there's certainly no blood circulation, it has no function, so I would rather cut it properly and join it with a few stitches [shows a uniting gesture with hands], so I don't understand … On the other hand, if you keep it at this phase, you could later see and maybe cut it and stitch it, or not cut it – but honestly, I don't know. But it may help in reconstruction [in the anastomosis] if it holds it in place.
S3: I would cut it. You can't put anything on it. On such a small isthmus.
S2: Me too, I would have cut.

Surgeon 1 questions his decision. He seems to focus his reflection on his relationship with this object of "putting some sutures", by encouraging his colleagues to give their comments. He used the eyes of his colleagues, their external perspective, as a resource to observe and evaluate his own activity differently. Surgeon 4 provides many justifications in a dilemmatic way, and notes the "help in reconstruction" (which is the same object, we interpret, as easy anastomosis). The intense participation and shared inquiry

show how the object of the psychological activity of Surgeon 1 is shared by all the surgeons in the workshop.

During the workshop, the surgeons said that they planned to organize meetings for watching selected video excerpts together, also after the intervention. This idea may materialize later as a new organizational practice. This would also strengthen the local community spirit of robotic surgeons, as expressed by a surgeon later.

6 Discussion and Conclusion: How Do Objects Evolve in the Self-confrontation Process?

The dialogue in the intervention, facilitated by the researcher and the video excerpts, makes the relevant objects of the surgical activity sharable among the participants. This is accomplished thanks to the intervention framework, in which video, questioning by the researchers and talking to peers make actions and objects emerge. Just as the robotic camera changes the surgeons' viewpoint regarding the patient's body and operation process, so does the intervention, albeit in an unusual way. In this paper, we conceptualize this change of viewpoints as evolving objects.

The camera of the robotic device producing the digital video images is perhaps the most important technical object from the perspective of this paper. Its role is crucial in the surgical operation for transmitting the ongoing visual image for the team. In the research, researchers and professionals select some video excerpts to be shown in the intervention encounters. The fact that the video clip is also an outcome of the surgeons' own collaborative activity may enhance engagement and learning when watching and reflecting on them. Although not totally neutral, the video images still offer an objective view to what happened in a particular work situation. The power of video excerpts in self-confrontation encounters is in showing numerous material objects in action. The concreteness of the objects in the video excerpts, present in all phases of the self-confrontation process, is a rich resource for reflection and interpretation in the intervention. Some objects in the video are taken into participants' discussion and others are not, which is an interesting theme for further study.[3] In our case, the extra hole in the urinary bladder was such an object. Our study contributes to discussions of the pedagogic uses of digital visual images, increasingly important in both workplaces and society.

Inspired by the notion of sociomaterial assemblages [1], we use the temporal intervention process to trace the appearance of the objects. The dialogue in the first intervention encounter identified a material object (the hole in the bladder), the concrete action taken and a possible alternative action for dealing with this situation. Our analysis uncovered how various situated and psychological O3 objects were taken up in the

[3] The robot is both an instrumentality and a medium [38], as it modifies the modes of perception of the environment. The technical objects of the robot were not often taken as objects of dialogue by the surgeons in the self-confrontation process. The robot may be such an intimate part of the everyday organizational experience that it becomes "invisible' [1].

discussion. They function as organizing situational actions, but they may be partly implicit for the actors. They are expected to either help the fluidity of the operation or contribute to other societal and functional objects of the activities. The O3 objects are flexible and dynamic – individual surgeons may harness them into use as either a standard or occasional practice. The material and technical objects visible in the video excerpts were crucial in revealing these organizing objects and enabling their articulation in the dialogue.

The second, crossed self-confrontation with two professionals made the O3-type objects ones of dialogue and disagreement (O5). The research point in raising them for discussion is not to judge what is right or wrong, but to better understand this work activity by supporting professional development through discovering and reflecting on the variation of its objects. In the third encounter – the workshop – the same initial object seen in the video gave rise to yet another O5-type object: a professional taking his relationship with his action as an object of dialogue, using his colleagues' perspectives as resources for reflection. Through objects of the O5 type, an action may turn into a means of thinking about other possibilities. The active participation of professionals shows the shared nature of this object. The temporal sequence of evolving objects is visualized in Fig. 4.

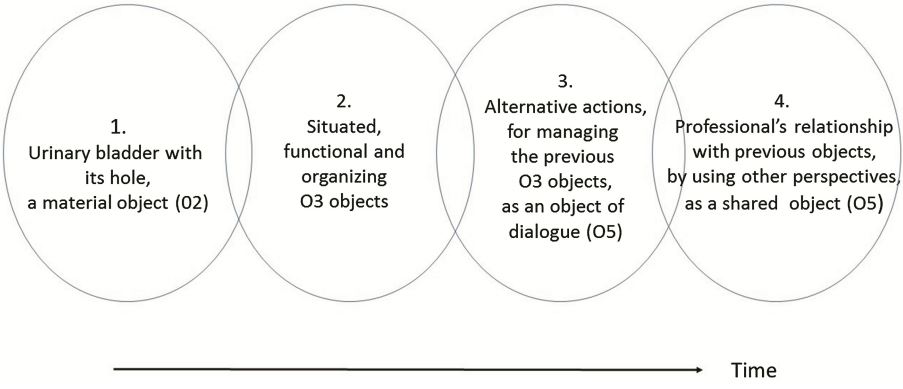

Fig. 4. Evolution of objects in the self-confrontation process

The variation and complexity of the objects is of interest for the study of making new connections in interpretive practice [18]. The development of the objects of the activity in the intervention is supported by the research framework, which offers a strong focus on a shared analysis of the activity of the surgeon, based on video clips of real operations. This shared analysis then intertwines two related activities: one activity concerning joint observation of the significant details of their actions, based on concrete visual images of their own working; and an activity of dialogue, in which the questioning and reasoning regarding situations and alternative actions – thus enhancing the interpretive practice – is first experienced at the interpersonal level, through dialogical exchange, before being experienced at the intrapersonal level, as multiple possible viewpoints of one's own activity, offering perspectives for its development. Turning

back to the objects and their development, which we have traced in our exploratory analysis as analytical tools to help understand complex technological activities, we show how O5-type objects of dialogue appear in the discussion from O3-type psychological objects, which are not usually easily shared or observed in everyday practice. These O5-types objects of dialogue may then become O6-types objects of thinking, which may be a means of considering other possibilities, and therefore have some potential for transforming the material and organizational objects (01- to O3-type objects of the concrete surgery activity). Therefore, throughout the intervention, the focus may shift from production activities to ways and means for developing these activities. This is why we call this kind of research developmental.

We see the intimate connection between different types objects. The main social object of removing the cancerous prostate would not exist without the material prostate in the human body or the technical instruments for removing it. However, differentiating between these object types facilitates analysis, for both researchers and practitioners. Thus, the dialogue around these objects may strengthen individual, collective (in the community of surgeons) and organizational development. Although we did not yet analyse the objects of thinking of the O6 type, the surgeons' interest in continuing to collectively watch the operation video excerpts, and their expression of how the intervention strengthened their local community spirit, indicate positive outcomes of self-confrontations. However, the intervention needs to be evaluated further.

Activity-theoretical interventions differ from many other developmental approaches, as they focus on concrete human activities and their objects. The objects of professionals' work, often in their material and concrete forms, are made visible for collective reflection, learning and revealing developmental possibilities. Despite the ambiguity of the concept [39, 40], objects of activity are powerful sense-makers that help anchor and contextualize subjective phenomena in the objective world. It is important that more subjective object constructions, such as those examined here, find a voice in organizational practice and research.

In this paper, we have, in an exploratory way, identified and analysed some objects in an intervention using the method of self-confrontation. The intervention related different kinds of objects; first the material objects transmitted by the video image to the psychological and social objects in the intervention encounters, which led to an idea of a new concrete practice. We see that the temporal process of self-confrontations is helpful in seeing different objects, their interrelations and their renewal. Activity theoretical developmental interventionist research could contribute to studies of technology and organization by revealing the complexity and evolution of objects.

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