Making Organizational Facts, Standards and Routines: Tracing materialities and materialising traces

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Introduction

"*One area where we are looking to cut waste and costs at the moment, is ink usage*" described Peter, the Managing Director (MD) of a newspaper printing factory[1]. He explained how ink usage had stood out as a particular issue when he was reviewing the monthly group figures produced centrally: *"I noticed that others* [other factories in the group] *were performing better than us on ink usage. We needed to find ways of reducing costs and waste in this area, so I got Matthew to look at it in more detail"*. In addition to raising questions about how certain issues become seen as a 'matter of concern' within this organizational setting – a problem to be solved - it also draws our attention to how we might study these issues in terms of the practices and process of organizing. While reducing ink usage is just one example of the complex and heterogeneous practices and relations which underlie newspaper printing, it provides an ideal case to study the process of fact, truth and decision-making within such a setting and how certain issues become translated into ideas of 'good' and 'bad' practice. Furthermore, through the concept of material memory traces we can begin to rethink ideas of materiality, space, time and action in relation to practices of organizing by unpacking and enhancing our sensitivity to these fact-making processes.

As soon as you walk into the organizational setting of an office, factory or shop, you encounter a wealth of forces, intensities, desires and beliefs emerging and vanishing through many different organizational practices, processes and routines. How these are experienced and enacted in different settings and through different events may depend on the ways in which these practices of organizing create particular signs, images and engagements, as they fold into other times and spaces. For instance, there may be settings where practices, actions and relations may not be visible to certain people who experience the apparently smooth running of the organization (e.g. customers in a restaurant or train users). In Goffman's terms, while the background often remains hidden from certain front stage views, when certain breakdowns or failures occur, they can become foregrounded and visible to users up front. This paper seeks to take this idea of background and foreground further by exploring the multiplicity of outcomes and possibilities not in terms of the different views of the spaces you may inhabit, but by examining the ways in which objects, subjects, boundaries and divides may be actualized through different events. Rather than different views of the same situation separated by a veil dividing front and backstage, this paper aims to explore how certain outcomes are performed through a continual process whereby intensive forces and relations engage through different signs and traces of action Through a focus on becoming, we can appreciate how the process of actualizing virtualities involves the assembling of many intensive forces, material relations, desires and passions.

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[1] All of the quotes came from discussions with informants who were fully aware of our role as researchers and that the material could be published as part of this research.

This raises the question of how we can become sensitive to the many different connections and traces of action which may emerge and engage with other actions and how these intensive forces become foregrounded while other may appear to fade away. In contrast to a process of linearity and continuity where traces exist out-there in some simple cause and effect form, the cauldron of becoming is an entangled mesh of complex foldings, relations and discontinuous links with connections emerging from diverse and heterogeneous forms. Not a scene of mess and disarray on one hand and fixed standards, procedures, and routines on the other, but one in which images of complexity and multiplicity as well as stability and order emerge together in the complex interplay of performances. Even in cases of apparent repetition of the same, a plethora of actions and agencies lies behind the different processes of assembling. Neither chaos nor simplistic determinacy, this is a process which encompasses the vitalism of action with the unpredictable repeatability of organizing, as certain intensive forces and acts of engagement seem more willing or able to assemble in particular ways.

While we have alluded to certain ontological and epistemological assumptions underlying this study, it is also important to foreground and clarify these in greater detail. Firstly, the research seeks to avoid a sense of organizations as existing as independent and discrete objects 'out-there', as social structures in some pre-existing form or as mere constructions or projections of the mind (McLean and Quattrone, 2005). In contrast, a focus on becoming rather than being, with a shift from nouns to verbs (e.g. organizing, informing, managing, etc.), allows the researcher to delve into the difference, work, effort and mediations which underlie a sense of endurance, stability and continuity. In other words, rather than apparent sameness and/or change emerging from the repetition of the same, we seek to explore how repetition is produced through difference and a process of becoming. This raises another related issue concerning space, time and action and how alternatives to Euclidean versions of space and linear understandings of time can produce very different accounts of action and agency. In other words, by investigating how techniques, practices, and actions may construct the image of isotopic and isochronic versions of space and time, ideas of linearity and the progressive arrow of time, we are not only able to challenge how these may impact on the research process, but also on the everyday practices of organizing. Finally, a focus on material memory traces attempts to provide a way of connecting these issues together in the study of organizing, artefacts and process. These traces are neither embedded in artefacts (e.g. determinist/materialist approach) nor in the mind (e.g. phenomenological approach) Rather, by exploring the making of connections and acts of engagements through intensive forces and actions which come forth from many other actions and events, it is possible not only to rethink action and agency, but also materiality, space and time. By challenging classical understandings of time, space, action and materiality in favour of ideas of multiplicity, heterogeneity, dynamicity and becoming, we therefore hope to provide ways of exploring in further detail how certain actions, facts and truths become performed and repeated into action through complex networks of actions, relations, connectivities and acts of engagement. This will involve delving into specific controversies and matters of concern, but also into the apparent stabilities and continuities associated with the activities of black-boxing and fact-making, which underlie specific organizing practices. Before examining the conceptual framing of material memory traces in more depth the next section will provide a background to the empirical research which underlies this study.

Fact-Making and Material Memory Traces: Problematising Ink Usage

Our view on objects, practices, action and materiality in relation to ideas of time and space is inspired by the work of the French philosopher Gilles Deleuze and by various ANT scholars (e.g. Latour, Law, Mol, Akrich). By rejecting objectivist and subjectivist modes of thinking in favour of non-representational modes of knowing (Thrift, 1996; Crang and Thrift, 2001; Thrift, 2008), these approaches enable the intricacies of organizing practices to be explored without holding onto *a priori* assumptions about objects, practices and relations in organizational settings. Furthermore, through non-linear understandings of time and space and via ideas of script, traces and the crystal-image, this paper will examine how ideas of stability and continuity can sit alongside multiplicity, heterogeneity and dynamicity. An ethnographic study conducted within a UK printing factory (Crystal Print: Northam) provided a wealth of experiences and events which helped to bring these concepts to life. Many

hundreds of hours of collecting and analysing data lie behind this research which began in 2007 and continued until 2013. There have been many different phases of study, including intense periods of research interspersed with more occasional visits, and a range of research techniques have been used based on an ethnographic style of investigation (e.g. formal and informal interviews, participation and non-participant observation, reviews of various forms of documentary evidence, and various modes of tracing and visualising different events and sets of relations). This allowed us to investigate in detail various controversies, problems and concerns as well as specific black-boxing and fact-making activities associated with the printing process. This chapter will draw on the specific example relating to ink density and usage within Crystal Print with a particular focus on the Northam factory. This will include exploring how the development of Lean Manufacturing within the organization relates to the process of ink usage becoming a matter of concern and how problems and solutions emerged in connection with this issue.

Many practices of organizing, such as standardized practices of recording, underlie the continuous process of production. While newspaper printing provides a wealth of examples relating to this process, the case of ink usage provides an excellent example to highlight the setting and enacting of standards in practice and how such a process links to many different aspects of organizing. Within the chapter we will focus in particular on how ink usage became highlighted as a specific matter of concern through different techniques of assessment, measurement, evaluation and fact-making and how these foregrounded ink density as a specific organizational problem to be solved. If we take the case of Peter (MD) and the raising of a concern over ink usage with Matthew (the continuous improvement manager), we begin to see how Lean Manufacturing was also in part performed through this event as well as the assembling together of many different distributed actions through particular modes of ordering and acts of engagement. For example, Peter, Matthew and a range of other managers have been keen advocates of Lean and in particular Peter has played a major role integrating Lean practices into Crystal Print. This includes a focus on waste and cost reduction, quality, visual standards, 5S, and new techniques of evaluation, communication and planning.

Lean has become big business in many areas beyond car and newspaper factories, with extensive developments in organisations such as the NHS. For example, a NHS improvement report describes how standard work is about establishing "*out of all the possible ways, the **best** work method of conducting a task and ensuring that everyone always works to this gold standard*". The focus is on reducing waste and increasing quality as "*standard procedures create stability and consistency in the system to produce high performance results every time*". (NHS Improvement Report, 2010:15). Lean also focuses on problem solving techniques such as 'A3 Thinking' and 'Plan, Do, Check & Act' cycles (PDCA or PDSA where study replaces check). The planning part of A3 problem solving and reporting involves defining the project, title, team, current situation, root cause analysis and the setting of goals and targets. The do stage involves the formation of certain solutions to counter the problems/causes already defined. This is followed up by a checking stage where the company may run trials and test the implementation of the proposed solutions in controlled settings. Finally, if the findings from the study suggest that the proposed solution/s match the target goals and objectives, then the new standards and processes are communicated and implemented to the wider organization.
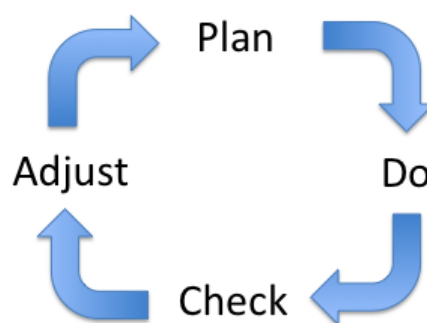
Plan/Do/Check/Adjust Illustration

When you look at the practices used by Matthew in relation to ink usage you can see how these many different Lean techniques (e.g. pareto, A3 problem solving, fishbone diagrams, etc.) have been incorporated into the everyday practices of analysing, recording, evaluating and constructing problems and possible solutions within the factory. This began with Peter raising ink usage as a concern when assessing how Crystal Print was using more ink per page when compared to other factories and how he requested further financial analysis by Matthew in order to produce a more detailed image of ink usage. The A3 report produced by Matthew also provides a good example of Lean practices and techniques. This includes starting with the statement at the top of the page highlighting the current state of affairs:

"Presently the Northam site is running the copy over inked, this is costing the site over 200 thousand pounds per year when measured against our closest competitor within the group.... 'our best performing site' presently print more copies than us per year but use considerably less ink" (Ink Usage Report, 2013)

We also need to understand how ink is seen as a central element underlying the offset lithographic process used by most commercial newspaper printers. For example, Lundström & Verikas (2013) provide a useful overview of offset printing, the major elements involved and the complexity of the process.

"Four primary inks, cyan (C), magenta (M), yellow (Y) and black (K), are used to produce colour images in lithographic offset 4-colour printing. A roller clothed with a rubber blanket, a steel roller sprayed with fountain solution which mainly consists of water, a roller equipped with a printing plate and finally the paper. The surface properties of the plates allow the ink roller to transfer ink onto dry areas of the printing plates. The ink is then transferred to the rubber blanket, which in turn transfers the ink onto the paper. A specific balance of the amount of ink and fountain solution has to be kept to maintain even quality throughout the whole print job. Other than this balance, parameters as paper properties, paper web tension, ink recipe, air humidity and temperature, ink temperature, wear of printing plates also affect the print quality."

While this extract introduces us to some of the complexities of newspaper printing, it is interesting to see how ink usage, via certain problem solving techniques, is constructed in particular ways such as through the A3 report. This includes the ways in which such a report plays a role in making different connections and assemblages and how it positioned certain problems and solutions in relation to ink usage. For example, different tables and charts are developed to support how the 'problem' of ink usage was related to the reduction of ink density. The following table provides a good example of this fact-making process as it seeks to highlight the way all the colours (i.e. black, yellow, cyan and magenta) were operating above the standard even at the start of this particular run. The table also provides a visual and numerical indication of how density increased during certain stages of the run and the level of 'over-inking'.

Colour	Density standards	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Mean	Over Inked
Black	**1.10**	1.16	1.12	1.20	1.18	1.18	1.19	1.17	1.17	0.07
Yellow	**0.75**	0.82	0.82	0.89	0.90	0.86	0.87	0.85	0.86	0.11
Cyan	**0.85**	0.96	1.05	1.03	1.13	1.14	1.12	1.11	1.07	0.22
Magenta	**0.85**	0.75	0.87	0.89	0.87	0.88	0.91	0.91	0.86	0.01

Ink Density Table (using example data)

Another section in the report also contained a list of action points which included: keeping to density on long runs (i.e. those above 40000 copies), reducing damps and ink throughout long runs, reporting any problems relating to ink and constantly working on the copy (i.e. checking the level of ink usage during the run). The report also outlined actions which had already taken place. This included: the ink

trials to test the ink curves and set density values for all titles with the ink suppliers; a presentation to all teams highlighting the cost of over inking and the importance of running to density; adjustment of damp curves on all presses; the purchase and calibration of densitometers for each press; monitoring of density on a daily basis; and a tracker to monitor density with the results fed back to the teams.

Finally we can see how the report translates the problem of ink usage into financial costs. This included highlighting a reduced expenditure in February of £3500 compared to the best performing site. In addition, the following graphs compared the performance of both the red and blue teams within Crystal Print by again comparing standards to actual ink density over a specific period. The text alongside these charts also wishes to draw the attention of the reader to the improvements in the use of black, even though there was still a need to reduce usage in the other colours.
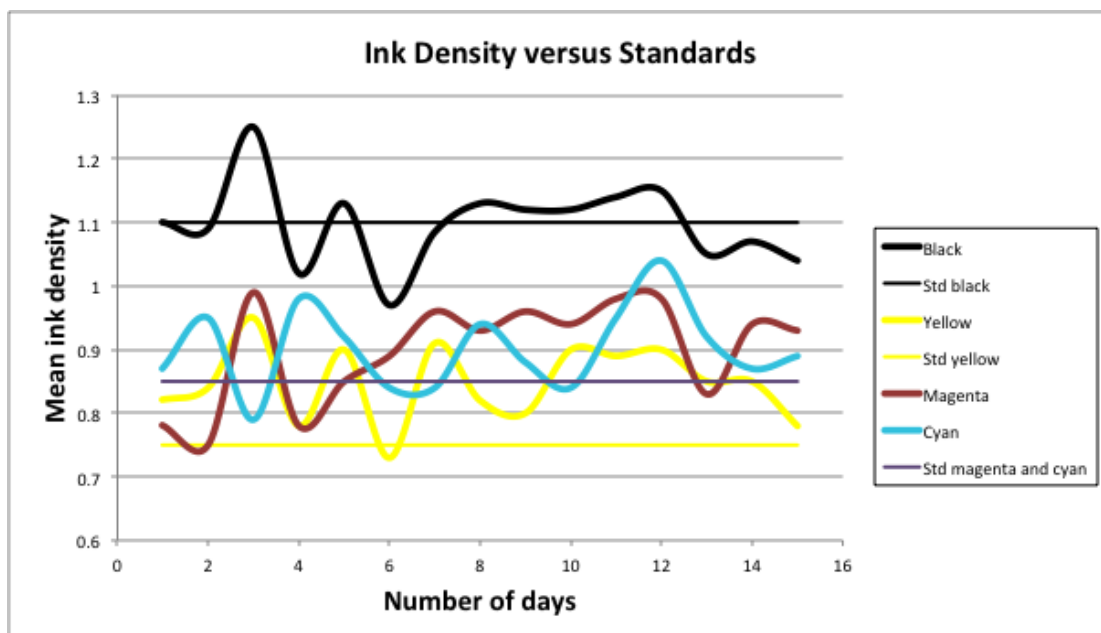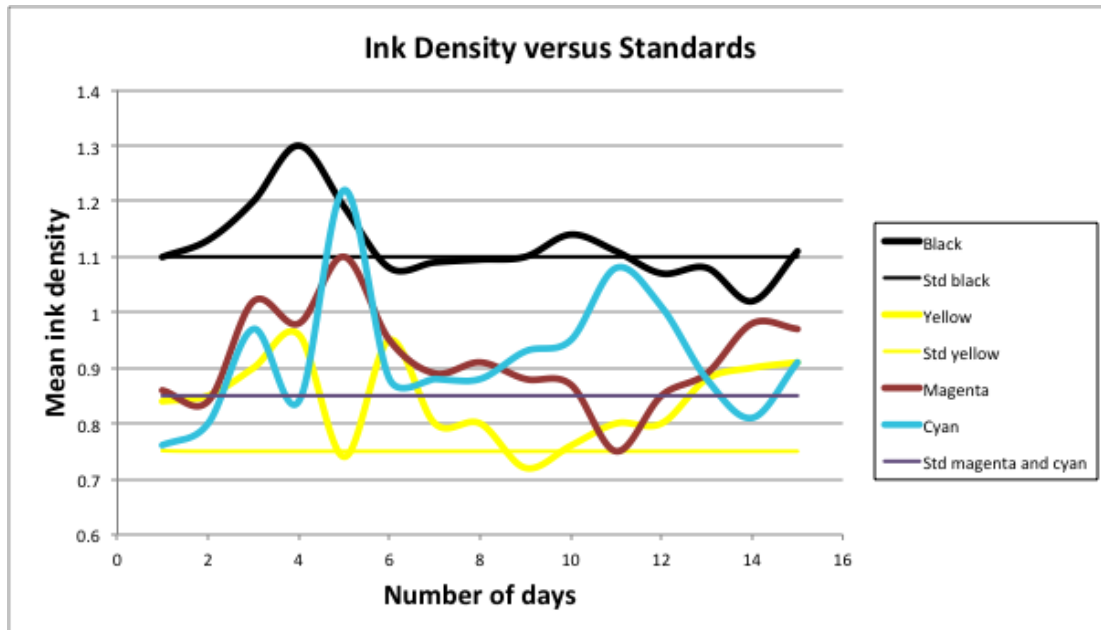
Ink Density Graphs (using example data)

In addition to the production of reports and the administration of trials, there were also several meetings which focused on the link between ink usage and density. Within these meetings, Matthew emphasised the need to pay greater attention to the monitoring of ink usage by comparing the actuals against standards (which were aligned to the international standards promoted by the World Association of Newspapers and News Publishers), the need to measure ink density with trackers and the feeding back of usage to the teams on a weekly basis. Densitometers were also purchased for each press for use on long runs. The printers were required to select a sample copy to obtain readings for each page of a newspaper for each of the four colours and the results were collated within a spread-sheet.

   While the imperative to reduce ink density could be simply viewed as a clear and coherent organizational strategy implemented by management, it became apparent that many different practices and fact-making activities were involved in the ways in which problems and solutions were defined and enacted in practice. This includes the many distributed actions and agencies involved in such events (e.g. the production of ink density readings and standards and how these become performed and translated within different events and settings) and the ways in which certain actions become black-boxed as standards, facts or taken for granted procedures through practices of simplification, measurement and standardisation. It was also clear that through certain events, black boxes were being opened up and unpacked as matters of concern leading to a variety of responses and types of action. Through the concept of organizational scripts and material memory traces, one can see attempts to repeat certain forms of actions and enact certain scripts (reducing ink usage and constantly measuring density) and how different mediations and what could be described as material memory traces come forth (e.g. a concern of the quality of an important advert on a page or attempts to balance water and ink levels). For instance, various printers raised concerns with the requirement to reduce ink density and described the potential consequences on the printing process. This included Paul, a number one printer who explained that: "*Since they decided to limit the quantity of ink we can use, they have had to increase the frequency of maintenance operations as presses would stop working more frequently [...], what they save in ink is spent on maintenance*". Another printer also commented that: "*We have to reduce ink density and it's a problem, we have to be more careful with the runs [...] and during long runs, things can go out of control and be very stressful*".

Some also remarked that while the reports outlined the overuse of ink, little was known as to 'why' more ink was being used when compared to other factories and standard measures. It was also interesting to see how certain managers accounted for the reaction by some printers to the continual checking of ink levels with the tighter tolerance levels and detailed reporting techniques. While a manager described this as a form of 'resistance' to change and to the increased workload, the printers provided very different accounts associated with these changes in the process of ink usage. This included the importance of monitoring production and ink density in many other ways (e.g. by looking at the printed output and comparing with other copies) and the many problems associated with the stricter restrictions on ink usage. For instance, the tighter tolerances were also seen to impact on other aspects such as water levels and some printers explained how this can lead to further short and long term problems (e.g. incorrect levels of water can lead to blobs of ink pilling up on the edges of the plates and this can cause serious damage to the press). They also emphasised the need for 'appropriate' levels of ink density to ensure smooth runs and the production of 'good' quality copies. A conflict was often described between reducing ink levels on one hand and producing lower quality copies on the other. While the managers involved in the project proclaimed the importance of reducing ink usage in order to cut costs and improve the efficiency of the printing process, the link to cost was seen by certain printers as another problematic element of Lean as everything was about money. As one printer described:

You can find yourself switching off as soon as you hear the word Lean as it usually ends up with something about cost cutting...we want to do a good job and print good copies, it shouldn't always come down to costs...the customers care about what the paper looks like and we have to make sure it's a good copy otherwise we won't have any customers at the end of the day.

While the printers are well aware of the need to reduce waste and costs, they also talk about those aspects which are not always accounted for in the drives to cut costs such as a reduction in the ink costs. This includes other elements, some of which could be translated into financial terms, although they may not necessarily figure in the ink reduction calculation or evaluation (e.g. customer dissatisfaction with poor copy quality; problems in post press; not getting the paper out on time leading to double runs; greater maintenance and engineering costs, etc.). Therefore printers can find themselves in a difficult position when assessing the application of standards, rules or procedures within everyday practice. For instance, one printer explained that "*if we followed every single health and safety directive in this factory we would never get the papers out on time*". He described how they continually weigh up the importance of different rules, regulations and procedures to evaluate which one works best in this situation and how to apply it. However, when observing the printing process and talking to the different printers it becomes apparent that some scripts and standards provide a greater intensive force and are more engaging or persuasive than others as they become taken for granted or hidden within black-boxed and simplified rules and practices (e.g. the established link between ink over usage and financial losses). The way certain rules and standards are assembled in tightly coupled forms therefore provides situations where certain actions and outcomes are more likely to come to the front, while others may go unnoticed whereas still playing a play a role in the development of various foregrounded actions, decisions and practices.

Organizational Scripts: Repeating standards, rules and procedures through difference

One possibility in terms of examining the ways in which certain actions are performed in practice is through the notion of organizational scripts and ideas of repetition and difference. These concepts can provide a way of delving into how different standards, requirements and rules may be-come together through certain practices and sets of relations (e.g. how the practices of the printers and the various monitoring and recording practices assemble through specific organizational scripts and practice). In this way, scripts can work as analytical tools which sensitise researchers to specific issues and practices of organizing which are enacted through different spaces, times and forms of action. It also shifts our thinking away from rules, standards and procedures as having some fixed and unitary status and operating simply in the image of sameness, linearity and stability. While a multitude of scripts may develop in different organizational setting, some may appear to foreground certain actions and practices while others may disappear or fade away as certain dominating scripts come forth. In contrast to the idea of scripts as fixed entities which denote particular sets of rules and standards, they become dynamic and fluid entities always in a state of becoming. Each script therefore works through complex relations performed through specific connections and associations. We can see examples of how scripts have been conceived within ANT through the work of writers such as Akrich (1992, 1993). This includes studies in which she explores how users and directives become in-scribed in particular technologies and how this script may be challenged through the 'practicisation' of the technology. However, rather than assuming that the technology is a thing that can become another in a different setting, we wish to focus on a different idea of dynamicity and becoming. In other words, instead of investigating how a script evolves through the confrontation of prescribed users versus actual users or through transfer via alteration (de Laet, 2000), we seek to explore how scripts are continually performed and re-defined in specific settings. As such, our emphasis is not on scripts as travelling entities, but on scripts which are performed and enacted through specific events and a constant process of assemblage (e.g. through mundane practices and acts of engagement associated with the reduction of ink density and the related practices, procedures, standards and measurements). In order to develop this idea further, we also need to draw on Deleuze's work on difference and repetition.

For Deleuze (2004) there are two forms of repetition: a simple repetition which conveys an image of sameness and linearity and a complex repetition which produces this simple repetition through the assemblage of difference. As such, rather than thinking repetition merely in the image of being, identity and sameness we also need to consider the making of this image in terms of difference – or better, repetition via difference. By relating these ideas of difference and repetition to our focus on scripts we can begin to delve into the complexity of everyday practice and the ways in which the process of

repetition can be influenced by a plethora of factors, parameters, actions, etc. Organizing scripts can then be explored in terms of their fluidity, dynamicity and adaptability, but also the ways in which certain material practices (e.g. rules, standards and procedures) which underlie the scripting process may perform relations of engagement in particular ways (e.g. through apparently standardised forms of associations). For instance, if we take the case of ink density, we can see how different scripts may be played out through the everyday practices of printing. Thus, by unpacking certain material traces of relations connected with particular scripts, we can begin to explore certain arrangements of repetition. This includes the fact-making activities associated with the problematization of 'good' and 'bad' practice, the different requirements of printing work and how the different organizational scripts emanate through specific encounters, tensions, mediations and negotiations.

This also raises the question of how to avoid taken for granted or *a priori* notions of being (e.g. a standard existing in some independent and discrete form prior to a particular event), while also making sense of the ways in which events rely on actions that may appear to come from other spaces, times and actions. Rather than seeing these as existing in some *a priori* form or just merely appearing from 'nowhere', this chapter seeks to explore ways of conceptualising action in a state of becoming, while recognising that other actions feed into this process through particular sets of relational engagements. This also avoids a constant shifting back and forth between objectivity and subjectivity or structure and agency and a search for being, with a focus now on the relational and processual assemblage of becoming.

Rethinking Space, Time and Action: Material Memory Traces

Although ideas of memory are often connected with the human mind, this chapter seeks to open up this concept to include other forms of agency, traces of action and materiality. In this way material memory traces can be seen as performing a rhizomatic function (Deleuze and Guattari, 2004) in enacting specific connections and associations between a multitude of entities, standards and practices. Such a shift in thinking also requires us to reconsider the notion of materiality. Instead of defining materiality as that which denotes concreteness and possessing *a priori* existence, we can see materiality through the prism of relationality, multiplicity and heterogeneity. By expressing materiality in terms of assemblage and texture, it is therefore possible to explore how locality and situated-ness sit alongside ideas of temporality and relationality. This then grants materiality an idea of connectedness and ephemerality combined with a sense stability and continuity.

By bringing together these two notions of memory and materiality with ideas of difference and repetition, we can also begin to examine how the concept of material memory traces can provide ways of reimagining the assemblage of different forces, intensities and desires through complex and diverse temporalities, spatialities and actionalities. Moreover, drawing together ideas of memory and materiality in this way involves more than a mere rhetorical shift or a linguistic twist, as it relies on a process of engaging deeply with the texture and depth of these assemblages in practice. By exploring this complex process of repetition, we can begin to examine how different connections, relations and material associations are assembled and maintained through certain acts of engagement and fact-making activities and how various times, spaces and actions may be enacted together through the image of simplified objects or black boxes, which appear to act through stabilized, simplified and enduring forms. Furthermore, while certain acts of engagement may produce images of isotopy and isochrony, a focus on the performance of material memory traces provides a challenge to the idea that these exist in some pre-given or potential state waiting to be realised. In contrast, the idea of material memory traces involves a conceptual rethinking of time, space and action. By challenging ideas of linearity, time ceases to be *chronos* and becomes *cronos* (Deleuze, 2004): a kairotic form of time. This rethinking of time needs to be accompanied by a rethinking of space. Interestingly, both post-ANT thinking and Deleuzian philosophy converge in terms of rethinking space. For instance, while Deleuze (2004) suggests challenging Euclidian understanding of space in order to engage with Riemannian views on space, Law and Mol (2001) insist on the necessity to think through network spaces rather than Cartesian spaces with Law describing ANT as "*a machine for waging war on Euclideanism*" (Law, 1999:7). In topological terms, through a focus on non-linear understandings of space, we can highlight how various

points (e.g. practices, actions or events), which may be more or less spatially close, can become linked to each other in a multitude of ways while nonetheless remaining disperse. Thinking through Riemannian spaces, network spaces, and through Kairotic time allows further exploration of organizational controversies without being tied to pre-existing ideas of standards, rules and routines. In other words, by using the concept of material memory traces to investigate what lies behind ideas of isochrony & isotopy, identical repetition and black-boxing/fact-making activities, we can delve into the many complexities, ambiguities and multiplicities associated with certain organizational practices. In order to unpack the concept of material memory traces we also need to unpack how it relates to other Deleuzian notions of signs and images and in particular the crystal-image.

Crystal-images, Signs and Material Memory Traces

In his seminal work on cinema theory, Deleuze (2005) develops the concept of the crystal-image or time-image. A crystal-image presents two facets, the actual and the virtual. While the actual relates to certain manifestations of events and actions, the virtual stands for the many possibilities surrounding events. These two facets are distinct, yet not indiscernible and their relation is very much that of togetherness and exchange: "*there is no virtual which does not become actual in relation to the actual, the latter becoming virtual through the same relation*" (Deleuze, 2005: 67). Deleuze's development of the crystal-image reveals two main fascinations: apprehending the complexity of time[2] (Deleuze, 2005) – and overcoming the distinction real/possible in order to put forward a new way to make sense of the set of potentiality and possibilities surrounding an event and its realisation. The crystal-image also enables us to capture the richness and complexity of actions and events in order to continuously navigate through various forms of time: the crystal-image is always in expansion and vacillates between the present that has past, the past that has been conserved in all his depth and the future which is yet to appear. As such, the crystal-image allows one to have a deeper and more comprehensive view and understanding of an event or controversy by investigating "*how spatially distant and chronologically separate regions were in touch with each other, at the bottom of a limitless time which made them contiguous*" (Deleuze, 2005: 111).

By engaging with the materiality of practices, we can further appreciate the constant interplay between the actual and the virtual via the assembling of facts, standards and actions. Moreover, by following certain material memory traces through crystal-images, we are able to challenge black-boxing practices and processes of simplification. Besides, Deleuze discusses the actual and the virtual in terms of "*the little crystalline seed and the vast crystallisable universe*" (Deleuze, 2005: 78) and we can see how this relates to the reciprocal relationship between the practices of simplification (and black-boxing) and amplification. The concept of material memory traces is therefore an attempt to become sensitive to this process. More specifically, it seeks to find ways of exploring how these temporal and spatial connections, associated with organizational practices of standards, rules and procedures, are performed and repeated through particular acts of engagement and fact-making activities.

An exploration into crystal-images and material memory traces also involves investigating the role played by signs in relation to the manifestation of the virtual and to the relation actual/virtual. Reflecting upon Proust's masterpiece, Deleuze (2008) distinguished between four types of signs: the worldly signs, the signs of love, the sensuous signs and the signs of art[3]. We can illustrate how the sensuous signs relate to the notions of crystal-image and material memory traces previously presented through the famous episode of 'la madeleine' as found in Proust' *In search of Lost Time: Swann's Way.* As Marcel sits in a Parisian Café he dips his madeleine into his tea and immediately experiences a sense of Combray where he visited as a child – rushing forth come images of his childhood, the many visits to his aunt Leonide during which he would eat madeleines, through the taste, textures and feelings of this experience. While this Combray rises up with an unparalleled magnificence, this is not Combray in some original form. In contrast, the material signs of eating the *madeleine* are seen to play a role in

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[2] See Deleuze (1986) for a detailed description of the reasons justifying the demise of the movement-image in favour of the crystal-image in order to explore time.

[3] See Bogue (2001, 2007) for an account on the role of these signs.

actualizing the virtualised version of Combray within this specific event. In other words, rather than an original madeleine or Combray existing out there in some independent form, particular versions of Combray are actualised via the assemblage of sensations, intensities and desires. Through the tasting of *la madeleine* and the signs associated with Marcel's experience, various connections, relations and engagement therefore become performed leading to the occurrence of this new version of Combray. This Combray denotes a sense of *relational materiality*, as it became through the assemblage of various sensations, acts of engagements, experiences, facts and signs.

A focus on relational materiality in this way allows us to explore the be-coming together of different intensive forces through certain signs, acts of engagements and associations. This also enables us to investigate the relations between a multitude of actors, facts and practices located across various forms of time, space and action. Also rather than connections between fixed elements embedded in specific times and spaces, the crystal image provides an alternative view of temporality and spatiality as enacted through particular performances and actions. This implies that material memory traces are not perceived as connecting entities located in different times and spaces, but rather as performing new spaces and times of action. If we link these ideas to our earlier concern for the process of repetition, we can highlight how through repetition via difference, it is possible to examine different ideas of space, time, action in relation to the practices of black-boxing, fact-making and simplification. The different ideas and concepts of scripts, difference & repetition, material memory traces, crystal-images and signs also act as many lines of flight (Deleuze and Guattari, 1987) as they feed into the wider interest of studying the repetition of organizational standards, rules and procedures through different idea of space, time and action.

Discussion and Conclusions

There have been many turns associated with organizational theory, studies of science and technology and within the field of information systems research. We have seen turns to practice, semiotics, process, performativity, and affect, to name but a few. These have all provided important contributions to rethinking the study of objects, artefacts, materiality and relations; however, the debate over certain issues of agency and action still continue. One area of concern relates to the ways in which we account for space, time and action within our research. This includes accounts which avoid both a fixation on determinist and linear versions of stability and change, on one hand, and subjectivist accounts of human meanings and interpretation on the other. Even some accounts which attempt to bring together the social (i.e. human) and material can struggle with how to conceptualise the relationship between the material and technological on one side and human action on the other. This can be particularly problematic in the study of certain everyday practices where one become entangled in a constant shifting between different positions of objectivity and subjectivity, structure and agency, stability and change, macro and micro and ideas of repetition.

As discussed earlier in this chapter, the study of standards, rules and routines within the newspaper printing factory provided an excellent setting to explore these complex entanglements and alternative ways of engaging in the study of space, time, materiality and action through the concepts of organizational scripts, the crystal image and material memory traces. In particular, this involved developing a non-representational approach which focused on the everyday practices of organizing and a process of becoming and repetition. Fundamental to this approach is a shift in thinking from the repetition of being, to a repetition of becoming. In addition to difference becoming the focus in terms of outcomes, the emphasis is on exploring the heterogeneity, multiplicity and particular fact-making activities which underlie specific forms of organizing. This includes certain 'stabilizing' actions of organizational scripts and material memory traces and the folding of many different actions, times and spaces into specific events and assemblages. In particular, the empirical case provides a basis upon which to examine how decisions and outcomes involve the assemblage of different intensive forces emanating from other distributed actions (e.g. black-boxing and fact-making) and how particular relational acts of engagement come together through certain organizational scripts and traces. In addition to viewing this as a process of simplification, as the amplified setting of the virtual is actualized into specific forms of action, it could also be viewed in terms of further amplifications, as these events

can create particular openings and closings. For instance, one of the aims of this study was to explore in detail how certain organizational scripts may play a role in performing specific forms of action and practices of organizing, such as black-boxing and fact-making activities. Within the printing factory, this was apparent in the ways in which ink usage became increasingly viewed as a 'problem to be solved' and the different techniques and practices of measurement and evaluation associated with this problematisation of ink usage. For example, when unpacking the different events of assessment and newspaper production it became evident that many different actions, spaces and times were entering and permeating through each and every organizational event. In fact, the role of different mediators in what could be seen as 'similar' events (e.g. setting ink levels) only became evident upon becoming immersed in different settings and observing the everyday practices of printers and managers. Also what may have been seen as taken for granted and stabilized routines, standards and ways of working contained many 'hidden' actions and material memory traces which play a role as silent presences in the everyday practices of printing. For example, when standing with the printers on the shop-floor and watching them adjusting ink levels, many different actions associated with the setting of ink standards and the development of densitometers to measure ink density, can be played out through the everyday practices of printing. This is not to say that certain standards fix the possibilities of outcomes in some linear or prescribed form, as these standards do not determine practice. Furthermore, in some cases of black-boxing and fact-making, intensive forces may assemble in ways which appear to effortlessly engage others through specific events (e.g. fixing the plates to the press), while in others cases, certain aspects may be raised as matters of concern and the outcomes can be very different. However, even in situations where printers are doubtful about a certain course of action (e.g. reducing the ink levels to a point where they feel the copy is below a level they feel satisfied with), they may still feel persuaded to make adjustments to comply with the standards set by the managers. Comparing how different events play out and examining how 'similar' events produce what may appear to be the same or different outcomes, therefore enable the researchers to search through the assemblage of difference and investigate how certain organizational scripts may be enacted through the folding and assembling of material memory traces. This included exploring how the figures on the ink usage spread-sheet produced by the continuous improvement manager were on occasions enacted differently in alternative settings. This included management meetings where the figures and graphs are treated as hard 'facts' as they compared the performance of different teams and production over a period of time, while within daily production meetings, these 'same' figures or deviations from standard could be discussed in detail as the team manager explains the 'reason' or the 'need' to deviate from the standard (e.g. problems with web-breaks or a maintenance issue which had a major impact on that particular run). However, when sitting in the management meeting where team performance is being compared in terms of ink usage, certain material memory traces may not become actualised as they discuss the specific graphs. Clearly, while in a sense all the memory traces enter the room of the meeting in the sense that the virtual always sits alongside the actual, what becomes actualized within specific events and settings depends on the organizational scripts underlying that setting and the intensive forces which foreground particular memory traces through certain acts of engagement. Some may enter as instances of 'absent presence' as they still remain as affective forces in the actions that follow (e.g. problematising ink usage through Lean techniques and the setting of standards) but the degree of affection may depend on the level of intensity and material engagement. Therefore, rather than merely attempting to define this setting in terms of the coming together of subjects and objects (people and things), the chapter has explored the assemblage of intensive forces and material memory traces through certain organizational scripts and practices of organizing. Moreover, rather than attempting to plot these traces via some sense of simple, linear and causal determinations and relations from past to present, this paper seeks to delve into a genealogy of difference. Not difference in the sense of chaos and disarray or merely different outcomes, but a search for alternative approaches to rethinking objects, materiality and agency; approaches which enable the study of organizational scripts and intensive forces which underlie the performance of standards, rules, routines and repetition and concepts which allow the researcher to become sensitive to the folding together of different spaces, times and action.

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