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Machine baptisms and heroes of the underground: Performing sociomateriality in an Amsterdam metro project

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Performing sociomateriality in an Amsterdam metro project

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Abstract

Purpose – The purpose of this paper is to apply the theory of sociomateriality to exhibit how the social and material are entangled and (re)configured over time and in practice in a particular organization of study.

Design/methodology/approach – The authors conduct an ethnographic case study of the North-South metro line project in Amsterdam and use the methods of participant-observation, in-depth interviewing and a desk study.

Findings – The authors showcase the process of sociomaterial entanglement by focussing on the history and context of the project, the agency and performativity of the material and sociomaterial (re)configuration via ritual performance. The authors found the notion of performativity not only concern the enactment of boundaries between the social and material, but also the blurring of such boundaries.

Research limitations/implications – Sociomateriality theory remains difficult to grasp. The implication is the need to provide new lenses to engage this theory empirically.

Practical implications – The authors provide a multi-layered lens for organization researchers to engage sociomateriality theory at a contextual, organizational and practice level.

Social implications – Insights from a historical and contextual perspective can help practitioners to become aware of the diverse and dynamic ways in which social and material entities are entangled and (re)configured over time and in practice.

Originality/value – The authors provide a unique empirical account to exhibit the entanglement and (re)configuration between the social and material in a particular organization of study. This paper studies a tangible organizational setting whereas prior research in sociomateriality mainly focussed on routines in IT and IS. Finally, the authors suggest the ethnographic method to study sociomaterial entanglement from a historical and contextual perspective.

Keywords Performance, Sociomateriality, Performativity, Project organization, Entanglement, Ritual

Paper type Case study

Introduction

On June 19, 2008, seven historical buildings in the monumental Vijzelgracht of Amsterdam prolapsed for more than 35 centimeters after subsoil leaked through the dam walls of the "North-South line" metro under construction (Berkhout and Rosenberg, 2008). Although the project organization proclaimed no earlier risks, all residents were evacuated from their homes as the structural damage endangered their living conditions. The public outrage, the political unrest and the media coverage that followed caused an immediate stop to the construction project. The project members accused the soft subsoil of being the perpetrator of this dramatic incident (Soetenhorst, 2011).

This example calls attention to the significance of the material in (project) organizations and their larger social settings. Namely, it shows that materials – in this case subsoil – are intrinsic to everyday practices and constitutive of social meanings

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and realities (Orlikowski and Scott, 2008). This is elaborated in sociomateriality theory which sees social and material entities as entangled and mutually enacting, rather than as separate and autonomous (Dale and Burrell, 2008; Orlikowski, 2007). Consequently, all organizations and processes of organizing are simultaneously social and material – i.e. sociomaterial – though what this means precisely remains unclear (Leonardi, 2013).

To better grasp sociomateriality, and particularly the material which has often been treated as peripheral, the notion of performativity has recently been applied (e.g. Orlikowski and Scott, 2008; Leonardi *et al.*, 2012). The performativity of materiality argues that the material, in assemblage with the social, is agential in the construction of meaning and reality (Robichaud and Cooren, 2013; Orlikowski, 2007; Callon *et al.*, 1986; Latour, 2005). Furthermore, it shows how boundaries between the social and material are not pre-given but incessantly enacted in practice (Orlikowski and Scott, 2008; Barad, 2003). This latter understanding follows the philosophy of "agential realism" where sociomateriality is understood as a (re)configuration of entangled agencies (Barad, 2003), thereby discrediting the ontological separation between the social and the material (Orlikowski and Scott, 2008).

While this relational ontology is philosophically enlightening, various scholars point out that it is also difficult to engage empirically (Mutch, 2013; Faulkner and Runde, 2012; Leonardi, 2013). That is to say, while it might be true that the social and material are always entangled, scholars question what the "social" and "material" are and how their entanglement takes place over time and in practice (Leonardi, 2013). In line with this, the aim of this paper is to apply sociomateriality theory to exhibit how the social and material are entangled and (re)configured over time and in practice. Accordingly, we ask the main research question:

RQ1. "How are the 'social' and 'material' entangled and (re)configured in a particular organization of study?"

To answer this question, we conducted an ethnographic case study of the "North-South line" metro project in Amsterdam and unfold its historical and contextual process of sociomaterial entanglement. In this process, we focus on a specific practice; the ritual performance of the baptism and name-giving tradition of the tunnel boring machines (TBMs) used to excavate the metro tunnel. We argue this ritual performance provides an ideal empirical account to show how and why the social *vis-à-vis* the material is reconfigured within a certain historical context.

This study contributes to sociomateriality theory in three ways. First, we provide the ethnographic method to exhibit the process of sociomaterial entanglement and (re)configuration over time and in practice. Second, we propose that performativity in sociomateriality theory not only concerns the enactment of boundaries in practice (Orlikowski and Scott, 2008) but also the blurring of such boundaries. Lastly, we offer a concrete organizational setting (i.e. a construction project) and a distinct practice (i.e. a ritual performance) to study the performativity of materiality, whereas prior studies in this research domain have mainly focussed on routine practices in IS and IT (e.g. Leonardi *et al.*, 2012; Orlikowski, 2007; Kautz and Jensen, 2012). Additionally, our practical contribution lies in the provision of a multi-layered lens through which sociomaterial entanglement can be analyzed at a contextual, organizational and practice level.

The paper is structured as follows. First we define the basic concepts of material, materiality and sociomateriality to clarify our theoretical foundation. Subsequently, we engage in the debate on the agency and performativity of materiality. Then, we discuss

the concept of ritual performance and explain why it lends itself well to study the performativity of materiality. Next, the methods of data collection and analysis will be described. After, the findings on the metro project will be presented with a focus on the sociomaterial entanglement, material agency and performativity and sociomaterial reconfiguration via ritual performance. The discussion section critically reflects on the findings while the conclusion provides theoretical and practical implications, research limitations and suggestions for future research.

Sociomateriality

In the academic debate on the material aspects of organizations the concepts of material, materiality and sociomateriality have different connotations (Leonardi *et al.*, 2012). The material is understood as an artifact's physical material, while materiality is the arrangements of this material into particular forms that endure across differences in place and time and are important to users (Leonardi, 2012). Orlikowski (2000) reminds us that all materiality is social in that it is created through social processes, and states that artifacts continue to evolve over time. Therefore, Leonardi (2012, p. 42) defines sociomateriality as the enactment of a particular set of activities that meld materiality with institutions, norms, discourse and all other phenomena we typically define as social. For example, Suchman (2000, p. 316) views a bridge as an arrangement of more and less effectively stabilized material and social relations. Importantly, sociomateriality has advanced our understanding of the social and material as incessantly entangled and mutually enacting, rather than as separate, autonomous entities (Orlikowski and Scott, 2008).

Besides these basic concepts, the notion of agency has gained the interest of sociomateriality researchers (e.g. Latour, 2005; Pickering, 1995; Leonardi, 2011). Leonardi (2013, p. 70) defines material agency as "the way the object acts when humans provoke it." In this way, materials exercise agency through their performativity (Barad, 2003; Pickering, 1993) or "through the things they do that users cannot completely or directly control" (Leonardi, 2011, p. 148). Human agency, in contrast, is defined as "the ability to form and realize one's goals" (Leonardi, 2011, p. 148). A main theory used in organization studies to explain the relationship between material and human agencies is Actor Network Theory describing how they transpire through their intrinsic and temporal alignment (Latour, 2005; Callon, 1990; Law, 2009).

Two important perceptions of organizational scholars on the relation between the human and the material are criticized. First, Putnam (2013) problematizes the tendency of scholars to privilege the social over the material, where objects are merely seen as signs mediated through humans. However, materials increasingly mediate human relationships in organizations as well, especially in circumstances when the latter becomes more dependent on the former (Cetina, 1997). Similarly, Suchman (2005, p. 379) reminds us that "objects are not innocent but fraught with significance for the relations they materialize." Second, organization scholars often treat the nonhuman as predictable (Putnam, 2013, p. 34). We agree with Pickering (1993, p. 562) who argues that materiality is a context "in which human agents conspicuously do not call all the shots," especially because humans cannot always control or predict the material. Rather, Pickering (1995, p. 25) describes the "mangle of practice" where material and human agencies temporally emerge in everyday practice, in a "dance of agency" which takes the form of a dialectic of accommodation and resistance.

Instead of focussing on separate agencies and dialectics, Barad (2003), followed by Orlikowski and Scott (2008), take a different perspective; that of "agential realism."

According to Barad (2003, p. 818), "agency is not an attribute but the ongoing reconfigurations of the world." To explain, she uses the concept of "agential intra-activity," which challenges the traditional notion of causality. Namely, "nonhuman" and "human" are not fixed or pre-given entities but constituted through their agential intra-action: "all bodies, not merely 'human' bodies, come to matter though the world's iterative intra-activity – its performativity" (Barad, 2003, p. 823). In this sense, "phenomena are the ontological inseparability of agentially intra-acting 'components'" (Barad, 2003, p. 815). Yet, intra-actions within phenomena enact separations between the human and nonhuman, which Barad (2003) calls making an "agential cut" at the local level of observation. Therefore, Kautz and Jensen (2012, p. 92) argue that humans "make – consciously or unconsciously – agential cuts, and explore and analyze what they see though a magnifying glass."

In other words, in sociomateriality theory the notion of performativity explicates how relations between humans and materials are not pre-given or fixed, but continually enacted in practice (Orlikowski and Scott, 2008). As such, it acknowledges the active role of materiality in the world's becoming (Barad, 2003). Most importantly, this notion of performativity discredits the ontological dualism between the social and the material to account for the diverse and dynamic ways in which the social and material are entangled (Orlikowski, 2007).

However, various scholars (e.g. Faulkner and Runde, 2012; Leonardi, 2013; Mutch, 2013) have pointed out that while the ontology of agential realism is philosophically engaging, it is also difficult to apply in a field of study. For example, Leonardi (2013, p. 66) argues:

> Although the philosophical rejection of a subject-object dualism in agential realism is attractive from a philosophical standpoint, researchers have a great deal of trouble using this idea to engage empirical data.

In an earlier paper, Leonardi (2011, p. 151) explains that even that even though the ontological claim that human and material agencies are inseparable might be true, because infrastructures are constituted of both human and material agencies, "we must be mindful that the ways in which those agencies are weaved together produce empirically distinct configurations."

Subsequently, Leonardi (2013) provides ways to help researchers apply the approach of agential realism. Specifically, he suggests researching how the social and material are distinguished and signified in accord with organizational actors' categorization of phenomena. Here, a distinction can be made between human and material agencies with respect to intentionality. While humans and materials are both agential, ultimately humans will decide how to appropriate, modify or respond to the material. Therefore, to study the (re)configuration of the social *vis-à-vis* the material, human intensions should be taken into account (Leonardi, 2011). Furthermore, he advises to specify a temporal framework to link the social and material over time and in practice. These strategies, in turn, allow the researcher to examine how the social and material are entangled to produce the sociomaterial in an empirically unique way (Leonardi, 2013).

In light of the debate on the performativity of materiality, we draw from the perspective of agential realism and use certain strategies to engage and exhibit this theory empirically. Barad's notion of an "agential cut" is useful as this provides an ontology of inseparability, but also a lens through which to investigate sociomateriality and the boundaries enacted between the social and material or the human and

nonhuman (Kautz and Jensen, 2012; Orlikowski and Scott, 2008). Additionally, we study the intentions and interpretations of our respondents to see how the social and material are distinguished, signified, reconfigured and interwoven. Furthermore, we provide a temporal framework by using the ethnographic method to study the process of sociomaterial entanglement from a historical and contextual perspective over time and in practice.

Performativity and ritual performance

To study sociomaterial entanglement and (re)configuration over time and in practice, we not only account for the history and context of our case but also focus on a specific practice at the local level of observation. In our study we focus on a ritual performance, defined as formal ceremonial practice performed at a certain time and place, with predetermined actors and audiences, and particular words, gestures and materials that construct meaning and reality (Van den Ende and Van Marrewijk, 2014). This builds upon previous organizational studies on sociomateriality which have mainly focussed on everyday, routine and often taken for granted practices that bring sociomaterial realities into being (Latour, 2005; Suchman, 2007; Orlikowski, 2007). Conversely, a ritual is an extraordinary practice that differentiates and privileges itself from other, more ordinary practices through its orchestrated performance (Bell, 1992; Turner and Schechner, 1988). In this way, ritual is appropriated as more powerful and significant, permitting it to (re)construct meaning and reality (Bell, 1992).

We argue that a ritual performance lends itself well to study the performativity of materiality because performance is embedded within and connected to performativity (Gregson and Rose, 2000). Here, the performance refers to embodied practice or "acting" of ritual whereas performativity refers to the meaning or reality it (re)constructs (Loxely, 2007). As such, ritual is a way of acting that does something beyond the performance of ritual itself (Bell, 2009; Tambiah, 1981), and where the assemblage of space, symbols, words, gestures and materials actively participate in the creation of meaning and reality (DeMarrais *et al.*, 1996; Turner, 1982; Boivin, 2008; Bell, 2009; Austin, 1963; Glass and Rose-Redwood, 2014; Barad, 2003). In other words, ritual's performative potential is enhanced with the performance of social and material elements that are interwoven and accordingly become powerful and powerfully experienced by ritual participants (Boivin, 2008; Alexander *et al.*, 2006). However, the performative power of ritual is limited, negotiated and, therefore, never a given. Rather, it must be strived for by ritual organizers (Bell, 2009; Koschmann and McDonald, 2015; Anand and Jones, 2008). Consequently, it is important to study how and why ritual is framed and performed to (re)configure meanings and realities in practice and within a certain context. We will do this below in the findings by studying the ritual performance of the machine baptism and name-giving of the TBMs in the North-South line project in Amsterdam.

Research methods and analysis

In order to take the material seriously, we need to understand what it really "does" in relation to humans in the context of a large urban construction project. Therefore, we followed the qualitative ethnographic method, which allowed us to "be there" and analyze sociomaterial entanglement over time and in practice in a particular field of study. Accordingly, this research is based on a case study of the North-South line of Amsterdam; an urban construction project initiated in 2002 to build the first subway

traveling directly from the north to the south of the city. According to Eisenhardt and Graebner (2007, p. 25), case studies emphasize the rich, real-world context in which phenomena occur, and facilitate theory building as unique analyses emerge from identifying patterns in the raw data of the case. This research is also "phenomenon-driven" (Eisenhardt and Graebner, 2007) as it focusses on a ritual performance during which the TBMs used to excavate the metro tunnel were publically baptized and named.

Data were collected by the first author over a three-year period between summer 2010 and summer 2013. To allow for systematic operationalization and triangulation, three research steps were taken: a desk study, participant-observation and in-depth interviewing. The desk study was essential to gain a thorough historical and contextual understanding of the case. Hence, an abundance of data were collected from newspaper articles, books, documents, reports, photographs and films, and by browsing the internet and web sites for news and information about the project.

Besides the desk study, participant-observation was carried out at construction site look out points, project excursions, open days and the information center approximately three days a week for three years. Important excursions included the annual "Day of Construction" on June 2, 2012 to visit the underground station and tunnel under construction at the Vijzelgracht, where the TBM could be witnessed at a standstill and tunnel constructors could be asked about their work. Another excursion was a day trip in March 2012, led by the technical director of the North-South line, to explore innovative methods of underground construction under the Central Station in Amsterdam. A private underground trip was also attended together with the supervisor of tunnel construction and Tunnel Godmother[1] to bring the builders cake in the south of the city. Here the workers showed how they froze and injected the ground to stabilize the earth 25 meters underground, giving a telling impression of the construction site which was cold, dark and moist. Furthermore, the first author lived in the center of Amsterdam at the time of data collection enabling her to see and experience the project on a daily basis, such as by biking passed the construction sites, watching how a chunk of the tunnel was sunk underwater next to the Central Station, or visiting the project during the Vijzelgracht incidents when various buildings prolapsed and residents were evacuated. Informal contact was also maintained with the communication team who kept us up to date about project matters and events.

In this way, researchers can gain a "feel" for organizational material by sensually experiencing spaces as they carry out fieldwork in organizations (Warren, 2008). By interacting with employees, researchers themselves can become valid sources of data through their own aesthetic experiences, refining their capacity to empathize with others and imagining what it might be like to be them walking through and/or working in these same spaces (Warren, 2008). Furthermore, participant-observation was carried out during two ritual performances. When the project officially launched the task of tunnel boring, a public ritual performance was held on March 11, 2010, in which the first two TBMs were baptized by a Catholic Priest and named "Gravin" and "Noortje." Subsequently, the same ritual was held to launch the third phase of tunnel construction on April 28, 2011, where the third machine "Molly" was also baptized and named.

During these events, an abundance of visual data were collected, both primary and secondary, in the form of films and photographs to (re)analyze the necessary details of the ritual performances. Materials are largely unacknowledged as a source of qualitative research data. Therefore, materiality was observed and analyzed as both a framework for and outcome of the phenomenon under study (O'Toole and Were, 2008; Van Marrewijk and Yanow, 2010). Symmetric anthropology assumes that material

objects and organizational spaces are connected to aesthetic experiences in a network, without being trapped in vulgar materialism (Latour, 1993) or material determinism, a view that the material world exhibits deterministic influence over the social world.

Subsequently, ten in-depth, semi-structured interviews were held with diverse project participants who were closely involved in the organization and/or performance of the ritual events and the metro construction project more generally. Interviews took approximately one to two hours and were directly transcribed from Dutch to English. The sample included five communication advisors of the project organization who organized the rituals; the Catholic Priest and Tunnel Godmother who performed the rituals; the team leader/supervisor and the director/contractor of tunnel boring; as well as the technical director during the metro project's preparation phase. We questioned the respondents about the project process more generally, and about how, when and why the rituals were performed more specifically.

The data were analyzed by studying how our respondents distinguished and interpreted the "social" and "material" to see how and why they are entangled and (re)configured over time and in practice (Leonardi, 2013). Furthermore, we devised a multi-layered lens to analyze our empirical findings on sociomateriality from a contextual, organizational and practice level (see Table I).

Sociomaterial entanglement in the Amsterdam North-South line project

Amsterdam, that beautiful city

It is built on stilts

If that city would topple

Who would pay for it?

(Proverbial children's song of Amsterdam)

In 1965, the Dutch Government decided to build a metro through the east of the city – the "East line" – which would be technically and socially less complex; or so they thought. To the dismay of many civilians, the East line would pass under the *Nieuwmarkt* on its way to the east, which is a monumental market square in the heart of Amsterdam just south of Central Station. Because tunnel bore technology in soft subsoil was not yet available, they would first build the 3.5 kilometer tunnel tube and then sink chunks of it underground via colossal concrete caissons. Unfortunately, this meant that a substantial part of the *Nieuwmarkt* neighborhood would be demolished (Soetenhorst, 2011).

When the demolitions commenced, the public responded with massive protests which went on for weeks, comprised mainly of squatters, artists, architects, journalists and academics who strongly rebelled against the metro project, portraying themselves as "monument protectors" (Soetenhorst, 2011). The protests, referred to as the *Nieuwmarkt riots* or, more generally, the "metro riots," were so fierce that the Dutch Government had to use teargas bombs and water cannons to keep the riots at bay.

Table I.
Levels of analyzing empirical data on sociomateriality

Analytical level	Empirical step	Analytical step
Contextual Organizational Practice	Empirical findings sociomateriality	Theoretical analyses sociomateriality

Many protestors were injured and/or arrested, and the majority of Amsterdam residents supported or sympathized with the protestors. As a result, the Minister publically stated that after the completion of the East line, no other metro would ever be built in Amsterdam, including the North-South line. After 1975, the word "metro" became taboo in Amsterdam (Soetenhorst, 2011).

This period of turmoil and the hushed years that followed formed the backdrop for the North-South line project, already formulated in the 1960s, which emerged again in the late 1980s. The technical director of the North-South line, largely responsible for the project's commencement, shared his experience with these plans during this time in an interview:

> I started with the plan at the end of the 1980s. That was a very difficult context, because the first experience with building metros was bad […]. This left deep traumas behind in the city, among the state officials, the people, and to a lesser extent the business. In this context we had to make plans to improve the public transport of Amsterdam (Interview, technical director).

He went on to explain that despite the ensuing trauma of the East line, the old plan of the North-South line kept resurfacing during discussions about improving the Amsterdam public transport because it remained "quite an addition to the system with a major transport-related value," he argued. Amsterdam was getting busier with more and more car traffic and the tram net was more or less complete. Thus, an underground metro seemed like the only durable way to improve the transport system. Another important reason for the reemergence of this plan was that they now had the necessary technical means, particularly a soft subsoil TBM. A TBM enables underground tunnel excavation without the demolition of aboveground buildings, which was the main issue to be avoided after the metro riots: "We had a solution; we could do it underground" (interview, technical director). However, because the TBM technique had never been used before in Amsterdam and especially because the city has such a watery underground, there were still very high risks and costs involved.

Material agency and performativity

The biggest fear concerned the subsistence of monumental buildings which rest upon a foundation of stilts, as the aforementioned children's song made clear. In fact, most of Amsterdam was built on stilts because of its watery base. Many wondered what would happen if the TBM passed the foundation poles of historic buildings. Would the poles collapse, sink or remain stable? Due to this uncertainty and to prevent the project via legal procedures an alliance of residents, state officials and politicians was formed called the "Abovegrounders." They claimed that the foundation of buildings was not strong enough and that the costs for construction would be too high for the state. Hence, in the 1990s, the majority of City Council voters was still against the construction of the North-South line. In 1997, opponents of the North-South line actually "won" the referendum, but this was proclaimed invalid due to an insufficient total amount of voters. "So we went on with the project" (interview, technical director). To prove to the city that the project was possible with minimum risks, the project organization initiated several test runs for the TBM technique between 1997 and 2002 in different areas in the Netherlands, such as Rotterdam and Barendrecht, led by the technical director and the Center for Underground Building. In many ways, the project organization felt they had to fight against the rest of the world (Soetenhorst, 2011).

The results and expert opinions of civil engineers were confident but mixed. It was predicted they could bore underground with a small chance of subsistence, and that

they could inject the ground with a mixture of grout which would stabilize the earth and prevent (further) subsistence. Nevertheless, some skeptical engineers argued that not all foundation poles "reacted" the same, meaning they could not always predict ground and/or pole movement as the TBM passed by. They also experimented with building concrete dam walls underground for the metro stations, up to 40 meters deep, which was generally successful but also resulted in elevation of the aboveground and/or subsistence of foundation poles, the audit committee warned. Moreover, it was argued that the grounds on which they tested were different than the grounds of Amsterdam's center: "How could you compare containers on stilts in Rotterdam with the ancient buildings in the center of Amsterdam?" (Berkhout and Rosenberg, 2008). Despite varied reports, the overall statistics and predictions of experts were promising enough for the Amsterdam City Council to approve the construction of the North-South line on October 9, 2002 with 29 votes vs 14. At the time, the estimated costs were 1.46 billion euros, the Amsterdam municipality would pay no more than 100 million, and the delivery date was predicted at 2007.

What followed next during the preparations were grave complications resulting in technical mishaps, major cost overruns and time delay. Most problems resulted from leakages in the concrete dam walls of the stations through which earth water spilled into the excavation sites, causing the subsistence of roads, railways and buildings in those areas, such as at Central Station, Damrak and Vijzelgracht. The incidents at Vijzelgracht were by far the most critical, drawing heated attention from the public and the media. This is where the first subsistence took place in 2004, causing seven monumental buildings to sink 2.5 centimeters into the ground. Then, in June 2008, four more buildings on this historic street sank 15 centimeters into the ground. Having reached the subsistence limit, they put the project on hold. After doing research to resolve the issue, they continued in September by freezing the ground or injecting it with a mixture of grout to stop further subsistence. However, shortly after, another six buildings sank up to 23 centimeters, also due to a leakage resulting in the residents of the buildings being evacuated. Further evidence showed that the concrete of the dam walls was of low quality, resulting in weak spots and the ultimate leakages. Consequently, the costs tripled to over 3 billion in total and over 300 million for the Amsterdam municipality, and the delivery was delayed to 2017.

From then on, the city was heaving with anger and distrust: "There were problems with trustworthiness, because it's all happening on the street, right in the middle of the city" (interview, technical director). However, the wound was much deeper than that because it had not quite healed yet from the past metro trauma. With the ghost of the *Nieuwmarkt riots* hovering above their heads, the project organization tried to keep silent about the building process and shut out the public, especially regarding complications and mishaps. However, the societal and environmental impacts of these mishaps were inevitable and unavoidable:

> There was a lot of suspicion. Our engineers had always shouted "it's all state of the art and nothing will happen. We make the road open once, cover it, and then we'll go underground." Then things went wrong at the Vijzelgracht. Then you really got this idea in Amsterdam, "well, they all say that it's under control and all state of the art materials and construction methods, but why does it go wrong?" Yes, and yet it goes wrong. Then the drillers came and then there was indeed a need to bring humanity back in (interview, communication advisor).

It became clear that a major underlying problem was figuring out how to break open the "metro taboo" and how "to bring humanity back in," which implies an extant separation

between the material and the social. Since 1975 the city had not spoken of another metro, and so when the North-South line project reemerged in the 1990s it happened largely behind the scenes. It was precisely this secretive behavior of the project organization that would stimulate such distrust among the city and trigger resistance. Every technical mishap was met with rage, essentially because the people were not honestly informed about the risks or prepared for the technical complications from the start:

> So, actually, I think because the curtains were so shut there was a lot of distrust over the process. So, at the end of 2009 they even established a political party called "Save Amsterdam." Well, the most important point for them was stopping the North-South line, and especially the tunnel boring. Because if the boring would proceed, then everything along the way [would collapse], including the Bijenkorf, the Munttoren [two famous monument buildings in Amsterdam] […] (interview, communication advisor).

Apparently, the word "metro" was still taboo, and the next steps to break this taboo would be crucial for the construction process and its entanglement with social and political spheres of the city.

Sociomaterial reconfiguration: the machine baptism and name-giving ritual

The skeletons had to come out of the closet, meaning that the project organization completely had to alter its management strategy and external communication and become more transparent toward the outside, interviewees explained. The project was too much focussed on the construction process while neglecting the communication and collaboration with the public and the environment:

> At the start, the project organization was only busy with the project, autistic behavior […] but we had to try to control what happened at the construction sites. That is a big undertaking, because you need a lot of collaboration from the outside, and we did not predict well enough how much we needed. It was not a given, and then we had a crisis […] I got a new director and they started building a new relationship with the environment (interview, technical director).

In this sense, the project was too technical in its attention and practice, where engineers and researchers took the lead and attempted to keep the public at a safe distance with promising predictions and calculations. This technical approach in project management is heavily criticized as it disregards a project's interrelation with social dynamics (Cicmil, 2006). So when things went wrong, the predictions had no more bearing which caused a lot of uncertainty and lack of faith from outsiders. As a result "the project had become a symbol of failures and mishaps," the communication director explained. Therefore, they had to change their approach:

> We wanted to make a movement towards the repositioning of the project, a project of engineers, researchers and rationality and distance and more research and so on – and in this positioning you saw that all faith had been lost from the stakeholders of the city – so we said we have to go another direction (interview, communication director).

Moreover, "the Monster called the North-South line" (Soetenhorst, 2011, p. 11) already caused so much upheaval and the TBMs had yet to arrive to bore the actual metro tunnel. In 2010 when the TBMs did arrive, the communication team came up with a unique strategy as part of their new approach that would break open the metro taboo and (re)connect the project with the people of Amsterdam: a ritual performance. When the project organization hired German construction companies, Zublin and Herrenknecht, specialized in TBMs, the team of tunnel constructors also brought with them a ritual: the baptism and naming of the TBM before it is put to use (this ritual

is very old, pre-dating Christianity). "They won't start boring without it," the contractor explained. While this is usually a private ritual for the construction workers only, the communication team deliberately externalized the event for the public:

> In most projects, the inauguration is very internally directed […] but in Amsterdam it became enormous. For the contractor that was something new, but also for us I must say. Yeah, it was so big; I don't think anyone ever did it in this way. But that was necessary, especially to give off that political signal towards politics and the environment (interview, supervisor tunnel boring).

When the project organization planned the first ritual event, during which the first two TBMs would be baptized as the official kick-off of the tunnel boring task in April 2010, they invited stakeholders such as state officials, politicians, contractors, investors, citizens and the press including journalists, photographers and television crews from both local and national news companies. Thus, the event was widely publicized and mediatized, even on a national scale. The ritual would be performed underground, but also aboveground in party tent set up alongside the abyss of the boring site reaching 25 meters underneath the surface. At the boring site, the machine baptism was filmed and projected live on a giant screen inside the party tent to be witnessed by the invitees, around 500 people, and even the entire Dutch public as it was broadcasted on the news.

During the ceremony, before the actual ritual performance, appetizers and (alcoholic) beverages were provided for the delight of the attendees and speeches were given by the city Alderman and project director in which the phrases "building confidence," "regaining trust and "respecting the workers" were repeatedly expressed. This is not surprising given the major set-backs encountered during this project's course of development. After the speeches were given, the screen went on for everyone to witness the ritual. The reporter at the tunnel boring site below began by providing the audience with various technical facts about the boring machines weighing 900 tons while she inquired several of the engineers who were also present at the site. All people at the site, approximately 25 persons, most of them constructors and all of them male except from the reporter, were wearing safety helmets and neon vests. Below, we share a vignette of the ritual performance to give an impression the observation in the field:

> It became clear that the ritual commenced when a Catholic Priest from Amsterdam dressed in traditional white and golden robes came to the fore at the dark cold construction site, wearing a helmet. He started by presenting a petite statue of Santa Barbara, a Patron Saint acknowledged by the Catholic Church as the protector of harm and later espoused by mine and tunnel workers for this very purpose. Then, as he recited holy texts from the bible he blessed water in a shiny goblet with which he then baptized the statue using a special staff. Subsequently, the names of the tunnel boring machines would be revealed. As they counted down, a giant poster was released from the first machine, reading "Noortje" in big bold letters, followed by the release of the second poster from the second machine reading "Gravin." The names were female as this belonged to the tradition, and they were chosen by two school children from Amsterdam who were also present at the site. The priest then baptized the machines as he had baptized the statue with holy water, finishing in the eminent words "in the name of the father, the son, and the holy spirit". Afterward, the statue of Santa Barbara was carried by the "bore master" and delicately placed in a glass cupboard hanging on the wall next to the machine; the shrine from which Santa Barbara would watch over the workers. Subsequently, the boring manager and the Alderman smashed a bottle of champagne against the first machine and then the second, after which confetti was cast down from above in celebration of this moment. At that time, above in the party tent, a group of engineers recited a traditional German mining song – Gluck Auf - after which a fascinated and clapping audience

> further indulged themselves with food and drinks, striking up vivid conversations in reflection of the bizarre yet intriguing phenomenon they had just collectively experienced (fieldnotes, April 28, 2011).

Understanding the performativity of materiality via ritual performance

Fundamentally, the ritual implicitly reveals what the TMB symbolizes for the people who work with it. Namely, the dangers and risks attributed to this machine's capacity traditionally gave rise to the need to bless and baptize it for safety, and to personify it with a female name, perhaps to render it less hazardous. The workers' lives depend on the machine's reliability. As the technical director explained:

> I think there is nowhere in the world where a tunnel boring machine went into the ground without this kind of ritual, because it is comparable to the blessing of a boat or an airplane. Why do we do that? Because with that object, this airplane, this boat, we will do things whereby we give our lives into the hands of this object […] so you are dependent. So, there is a sort of, you engage in a sort of relationship with that object, which you want to mark. Well, this tunnel boring machine is in this category. The teams of people that will work in this machine, their lives depend on the reliability of this machine.

Naming and baptizing a machine indicates how the object is anthropomorphized to give it a privileged, human status. The machine was already social because it was designed and constructed by humans in a particular social context and for particular social ends. However, this is implicit and indiscernible in ordinary, everyday life. Therefore, the ritual, as an extraordinary practice, makes this explicit by performing and manifesting the material's social significance. It also shows how human actors acknowledge the agency of the material because they do not have complete or direct control over it; i.e., "we give our lives into the hands of this object."

At first glance, it was unusual to see a decorated shrine encasing Santa Barbara, the holy protector of the tunnel workers, at the construction site. This divine image seemed to clash with the technical setting in which it was presented, occupied by tough male construction workers and staging a colossal machine which would soon eat away the earth to create a gigantic burrow under the city. However, given the danger of construction work, the difficult history of the project, and the intentions of the project actors, it can be argued this ritual was a conscious and explicit reconfiguration of the social *vis-à-vis* the material:

> It's not only about the machine but the people in the machine […] so here you have this movement of the humanization of technology; that is what we are really doing (Communication director).

Thus, analyzing the case from a performative perspective, it becomes clear that this ritual was not only symbolic but, at the same time, performative in terms of its social and material differentiation, signification and reconfiguration. As mentioned before, the event was performed for a public audience with the purpose of "showing another image of the project than only all the costs and mishaps" (interview, communication director). Due to the technical risks and mishaps, the materiality of the project had been negatively perceived by outsiders and so they consciously performed materiality in a different way to change the public perception of the project. The communication director explains:

> The basis [for the ritual] was support, to regain trust in the project, in the people that make the project […] After the subsidence the project shut like an oyster […] so we said a part of our

> new course is to open up, as much as possible […] To involve the city by opening up the construction sites, to show the rituals, by sharing these moments with people, very transparently and realistically, to share the risks openly, to stop covering things up, [to say] "it is what it is", to tell that to the outside, to the press.

Thus, within this particular context, the ritual was especially significant for the public perception of this project with which it had struggled so much. Many people of the city resisted the project due to the (possible) aboveground impact, which the interest group "the Abovegrounders" made quite clear when they attempted to shut the project down. Hence, the project organization intentionally redirected the attention of the people from aboveground issues to the underground space and materials through the ritual performance. And, rather than communicating toward the public in terms of words, the ritual framed the space and the materials and communicated what words could not capture. It was first and foremost aesthetic, visual and material: the deep underground construction site was staged and made visible, the tunnel constructors were positioned at the front wearing safety vests and helmets, the authoritative Priest wore traditional robes and recited a holy script, the water was blessed into holy water, the statue blessed and placed in a shrine, the machines baptized and named, the champagne bottles smashed against the machine and confetti tossed onto the construction site. The machine was by far the most visible of all, placed at center stage:

> That just delivers beautiful images […] with such as machine, that's beautiful isn't it? It's huge, it's awesome, there's something to film and something will happen […]. With this you make headline news (supervisor tunnel boring).

Not only were the rituals highly material, they were framed and performed in order to exhibit the meaning of the material and the practice of tunnel boring. Specifically, the tunnel workers attribute a different meaning to the machine and their practice than the people of Amsterdam, which the ritual embodies and manifests. Conversely, for the people of Amsterdam the machine and construction work was perceived as nonhuman, intrusive and destructive. This is a major reason why this ritual was performed publically in this particular context to transmit the workers' meaning of their craftsmanship to the people of Amsterdam. For example, a communication director explained:

> We consciously decided to direct it at the craftsmanship, the men who do the work, to put the men in front of the machine, and this gives the image of the "heroes" […] and here is mystique, magic, heroism, but also fear and the need for protection.

He goes on to explain that this involved a shift in communication; away from the calculations and predictions (i.e. a more technical focus) toward the men who work so bravely underground in the machine (i.e. a more human focus):

> That is what we wanted to convey, away from the researchers and calculations and engineers to the men who sit behind the machine, this message of safety, because you know that when you are in the machine the men have no other motive, no alternative motive than doing their work safely, because the first one who is the victim is the man in the machine underground. So, who will you believe? Him, right? Here is something authentic […] we consciously chose for this, this approach, and this ceremony fit in that.

From the quotes above it becomes evident that the materiality is attributed significance and acknowledged agency through ritual performance. Namely, the significance of this machine is that the lives of the workers depend on its reliability, meaning that the

material is agential in that it is not under the direct or complete control of its users (Leonardi, 2011). Because of its inherent performativity and agency, the machine is privileged and placed on a pedestal and a collective, public awareness of the machine's social significant is created through its baptism and name-giving. Findings suggest this is an explicit reconfiguration of the material in relation to the social to serve particular social ends in the context of this project.

Interesting is that the ritual enacts certain shifts and changes from a performative standpoint. This means that the ritual constructs a particular meaning and reality, having performative power effects in terms of what it can establish or transform (Bell, 2009; Alexander *et al.*, 2006). For example, once the machine is named it will be referred to by its name by the project organization, the media and often also the public:

> What I found extraordinary is, for instance, that the whole name-giving, that this was adopted by everyone who followed us, that in the press they consistently used the name by calling the bore machine "Victoria" or "Molly" (Interview communication advisor).

It also transforms the meaning of the machine, which is a clear indication of performativity:

> If you see the bore, it is an enormous thing […] There is nothing sweet about it actually, but if you give it a name, then suddenly it becomes sweet and human (Tunnel Godmother).

Moreover, only once the machine is baptized and named it can actually be put to use because the ritual performatively enacts what we call a "point of no return." Specifically, once the machine is baptized and named, the tunnel boring is launched and there is no going back:

> [With the ritual] you as a project show very clearly "well, the machine is here, it exists, it is no longer a vague story about the future, but that it's *really* happening. We are here, the people are here, the machine is here, we will start boring." So this was a very important signal for the public relations, but also, yeah, for the environment around the boring contract (Interview supervisor tunnel boring).

The communication advisors explained that it was important to do this so manifestly to make known to the public that the tunnel boring could no longer be resisted, but that it was really happening. The communication strategy of the project actors, including the ritual events, was widely regarded as a success in Amsterdam confirmed by the Amsterdam Communication Award which they won in 2013. Another interesting point to mention is that the communication director of the team is an anthropologist who thought of the idea to publicize the ritual to appeal to the public of Amsterdam due to its social and symbolic significance. Whether the ritual appealed to everyone and what its broader impact or value was cannot be easily discerned. This is because performative power effects are limited and highly negotiated, not to mention that, to this day, there remain critical opponents of the project. Nonetheless, gaining insight into how and why this ritual was performed within the particular history and context of the project is valuable as it gives us in-depth insight into an empirically unique process of sociomaterial entanglement and reconfiguration.

Analysis and discussion

In this research we found that our respondents differentiated, categorized and signified the social in relation to the material which, together, constituted their entanglement and reconfiguration over time and in practice in empirically distinct ways. Respondents

generally interpreted the "social" as the people of Amsterdam and the social, cultural and political issues and meaning attributions regarding the project process and history of metro construction. On the other hand, the "material" was understood as the physical construction process, including its structural impact, the construction sites and technology and the machines. To help apply sociomateriality theory in our case study, we use a multi-layered lens to analyze our findings. Specifically, three main levels emerged from our study with which we could structure and analyze our empirical data on sociomaterial entanglement: at a contextual level, organizational level and practice level. These are displayed in Table II.

When analyzing our findings at a contextual level, we "zoom out" on the case and follow the historical and contextual process of sociomaterial entanglement over time in the city of Amsterdam more broadly. In doing so, the entanglement between the social and material becomes apparent over time. The historical account of the case underlines the arduous process of metro construction since the 1960s, which resulted in metro riots and a metro taboo, yet to be broken. A "metro taboo" is, in itself, an epitome of sociomaterial entanglement. In this context, the North-South line had to be constructed which turned out to be a highly sensitive and difficult endeavor. Especially the incident of the subsoil leakage at the Vijzelgracht roused much social and political unrest. Thus, it becomes evident that the materiality of metro construction (i.e. the "material") increasingly became (more) entangled with social and political spheres in the city (i.e. the "social"), to the point where human agents, fearing the material agency, actively turned against the project and even attempted to shut it down, such as the groups "the Abovegrounders" and "Save Amsterdam." The people of Amsterdam distinguished and signified the project and its materiality as in human and destructive, seemingly wanting to "disentangle" themselves from it.

At the organizational level, and according to our respondents, a discrepancy between the social and material can be discerned. Project actors struggled to control or predict the material by laser measurement technology, freezing methods, grout injections and warning systems. They could not control the material at all times, nor prevent the Vijzelgracht prolapses. The fact that they had no real control and could not predict how the material would "act" when provoked is a clear indication of material agency (Leonardi, 2013). Though project engineers claimed to have "state of the art" technology, the materiality became a context in which human agents could not call all

Table II.
Sociomaterial entanglement at different levels of analysis in the case study

Level	Empirical findings	Analysis of sociomateriality
Contextual	Difficult history of metro construction Metro taboo	The material and the social become increasingly entangled over time
	Social and political unrest and resistance among the people of Amsterdam	There is no social without the material and no material without the social
Organizational	Technical problems and mishaps despite promising predictions and calculations	The material unpredictability led to a separation between the social and material
	The project actors struggled to predict and control the material	Human and material agencies emerge through their agential intra-action
Practice	The ritual performance attributed meaning to and performed the material to "bring humanity back in," through "the humanization of technology"	Sociomaterial entanglement is exhibited to overcome the social-material struggle The boundaries between social and material agencies are blurred

the shots (Pickering, 1993). This showcases how human and material agencies temporally emerge through their agential "intra-activity" (Barad, 2003). Hence, these findings confirm the performativity of materiality in that the material is equally agential and co-constitutive of reality (e.g. Barad, 2003; Aradau, 2010; Orlikowski and Scott, 2008; Putnam, 2013) such as subsoil leakage during the Vijzelgracht incidents.

At the practice level or local level of observation, we analyze the ritual performance. Rather than relying on technological calculations for control and predictability, the project organization turned to a ritual performance traditionally practiced by tunnel workers to reconfigure the project, the construction process and the machine (i.e. the "material") *vis-à-vis* the people of Amsterdam (i.e. the "social"). Though highly symbolic and seemingly irrational in its performance, the way the ritual was performed in this project and context was intentional for communication purposes; to transform the public perception of the project and its materiality. Project actors mentioned there was "a need to bring humanity back in" via the "humanization of technology." This is indicative of an extant separation between the social and material, where discursively and materially situated humans enact boundaries and make "agential cuts" to make sense of and attribute meaning to their perceived reality (Barad, 2003; Kautz and Jensen, 2012). Consequently, during the ritual the material was made visible, sanctioned and performed, especially the machine, to differentiate and signify it as human, cultural and even sacred. Hence, the ritual can be seen as a reconfiguration of the social in relation to the material by explicitly performing and manifesting their entanglement in a unique and meaningful way such as the Priest blessing and naming it, the Aldermen breaking a champagne bottle against it, and the workers placing a shrine with a sacred statue next to it. In light of these findings, we analyze this ritual as an exhibition of sociomaterial entanglement because the ritual served to blur the boundaries that were perceived between the social and material. It follows that the notion of performativity in sociomateriality theory does not only underline how boundaries between the social and material are enacted in practice (Orlikowski and Scott, 2008), but also the blurring of such boundaries.

Regarding these analyses, a point of discussion is to what extent they showcase entanglement from an agential realist perspective (Orlikowski and Scott, 2008) which sees the world as a (re)configuration of entangled agencies that are indistinguishable (Barad, 2003). At the contextual level, we argue that material and social agencies are not so easily set apart when describing the historical context of the case at a higher level of analysis. Here, there are manifold and dynamic ways in which social and material components are and/or become entangled over time, such as the metro taboo. However, because the people of Amsterdam turned against the project, distinct human and material agencies become visible. Subsequently, at the organizational level of analysis, a separation becomes more discernable as project actors attempted and struggled to control and manage the material. On the other hand, we see that the material, too, "responded" when provoked, such as the leakages or prolapses. Though the material does not act intentionally, we argue it is just as significant and performative according to an agential realist perspective. In this sense, there are multiple intra-actions between social and material agencies which constitute organizational processes and activities. Then, at practice level we analyzed the ritual performance as a reconfiguration of the social *vis-à-vis* the material. Specifically, the project actors intentionally performed the entanglement between the material and the social by baptizing and naming the machine. While social and material components were already entangled in this project, which was made clear at the contextual level of

analysis, there was a negative social signification of the materiality in this project. Therefore, the ritual re-signified and reconfigured the materiality. Specifically, the organizational actors transmitted the traditional meaning the machine had for the tunnel workers to the public of Amsterdam to redirect their attention away from aboveground issues (such as the prolapse of buildings) to underground matters (such as the craftsmanship and safety of the workers).

Ultimately, it is humans who ritualize the material which highlights the difference in human and material agencies in terms of intentionality (Leonardi, 2011). Yet, the ritual would not exist if it was not for the innate entanglement between the workers, the machine and the practice of tunnel drilling. Like the metro taboo, the ritual epitomizes sociomaterial entanglement. Therefore, at the local level of observing the ritual phenomenon, social and material agencies cannot be reduced to distinct entities, in line with an agential realist perspective. Therefore, concerning the ritual performance, the performativity of materiality underlines the blurring of boundaries between the social and material, rather than the enactment of such boundaries (Orlikowski and Scott, 2008).

We agree with authors (Faulkner and Runde, 2012; Mutch, 2013; Leonardi, 2013) that it is indeed difficult to grasp the ontological inseparability between social and material entities from the perspective of agential realism. Therefore, while maintaining the ontology of inseparability theoretically, we used certain methods to engage and exhibit this theory empirically. Furthermore, we provide a lens to study sociomaterial entanglement at a contextual, organizational and practice level. Here we found that analyses on sociomaterial entanglement depend on the level of analysis (see Table III).

Overall, though we see contexts, organizations and practices as (re)configurations of both social and material entities, we agree with Leonardi (2011) that we must be attentive to the diverse and dynamic ways in which these agencies are interweaved to construct empirically unique configurations. In line with this, we argue the use of the ethnographic method to study a particular case over time and in practice provides an ideal empirical approach to engage theory on sociomateriality and the performativity of materiality.

Conclusion

The purpose of this paper has been to apply the theory of sociomaterial entanglement to exhibit how and why the social and material are entangled and (re)configured over time and in practice, in a specific organization of study. Theoretically, we follow the ontology of inseparability as we view all organizational practices and processes as simultaneously social and material, i.e., sociomaterial. Yet, to understand this entanglement empirically we devised a multi-layered lens to explore sociomateriality and the boundaries enacted and/or blurred between the social and the material at the contextual, organizational and practice level. Consequently, we argue that the perception of entanglement or separation between the social and material depends on the level of analysis.

Table III.
Analyzing sociomateriality in an organization of study

Analytical level	Empirical step	Analytical step
Contextual	Focus on the historical context of the organization by zooming out	Analyze how the social and material are entangled over time, within context
Organizational	Focus on organizational processes, occurrences and activities	Analyze the intra-activity and agential cuts between social and material agencies
Practice	Focus on a practice at a specific moment in time by zooming in	Analyze how the social and material are (re)configured in practice

This study contributes to sociomateriality theory in three ways. First, we suggest the ethnographic method is well-suited to study sociomaterial entanglement from a historical and contextual perspective. Second, we propose the notion of performativity in sociomateriality not only concerns the enactment of boundaries in practice but also the blurring of such boundaries, demonstrated by the ritual performance. Lastly, previous studies on the performativity of materiality have mainly focussed on routine practices in IS and IT (e.g. Leonardi *et al.*, 2012; Orlikowski, 2007), whereas this study focusses on a ritual performance as a distinguished practice (Bell, 1992) in an urban construction project as a more tangible organizational setting. Additionally, the practical contribution of this study lies in the multi-layered lens we provide to study how the social and material become entangled and reconfigured over time and in practice.

While we attempted to apply sociomaterial entanglement in a particular field of study, we realize our study has various limitations concerning this aim. One shortcoming is the difficultly to exhibit sociomaterial entanglement empirically without resorting to dualistic thinking, an issue previously underlined by others (Mutch, 2013; Leonardi, 2013; Faulkner and Runde, 2012). To help us tackle this challenge we aimed to exhibit sociomateriality with the historical story of our case and devised a multi-layered lens to help us analyze our data from an agential realist perspective. We also struggled to showcase our findings without succumbing to the tendency to privilege the social over the material due to the qualitative nature of our research. We hope to have balanced this by emphasizing the significance and agency the material in our case study. To further test and build theory in this domain, we encourage future research to use ethnographic and interpretive approaches in a variety of organizational settings to study sociomateriality over time and in practice, and to analyze this theory from different levels and perspectives. We believe this will help fill the current gap between theory and practice concerning the study of sociomateriality.

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Note

1. A Tunnel Godmother is a female civilian symbolically appointed to represent "Saint Barbara"; the Catholic patron saint of mine and tunnel construction workers for safety and good luck.

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