Writing Choreographies: (STS) Knowledge Production in Post-digital Academia

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Abstract

In this paper we develop the notion of "writing choreographies" and explore the epistemic practices and politics of STS writing by drawing on a collective autoethnography of academic work. In particular, we analyse post-digital writing practices, where these are understood as distributed across different devices, tools, bodies, and spaces under conditions in which distinctions between "digital" and "non-digital" formats, practices, and objects are no longer clear. As in the choreography of a dance, writing choreographies emerge from dynamic movements across space and time, follow rhythms and patterns, and are shaped by aesthetic considerations. We argue that writing is choreographed through the artful arrangement and navigation of "seams" between different materialities of writing, and through configuring and "atmosphering" writing spaces. We explore how agency within writing emerges from aesthetic choices and practices, and how STS researchers are "made and done" within their research. As such, writing choreographies speak to the ways in which writers encounter and negotiate current academic structures and dynamics, such as acceleration and increasing pressure to produce concrete "outputs" such as articles.

Keywords

writing; choreography; epistemic practices; post-digital; aesthetics; materialities.

1. Introduction

STS has, from its earliest years, emphasised the crucial role of writing "as a process and a product" (Michael 2021, 139) of scientific knowledge production (Shapin 2010; Latour and Woolgar 1986; Callon et al. 1986). Interest has also extended beyond the scientific laboratory to attend to social science writing (Garforth 2012; Hoffmann and Wittman 2013; Jensen

2021), and to our own writing practices in STS (Lippert and Mewes 2021; Michael 2021; Downey and Zuiderent-Jerak 2017). Departing from the insight that writing is performative of the realities it describes (Latour and Woolgar 1986; Law 2004), as well as of the research cultures in which it is embedded (Knorr-Cetina 1999; Michael 2021), in this paper we develop the concept of "writing choreographies" and explore the epistemic practices and politics of STS writing by drawing on a collective autoethnography of academic work.

Two central questions animate our discussion. First, we are interested in how writing as a material-semiotic practice is distributed across different devices, (digital) tools, bodies, and spaces. Second, we are concerned with the epistemic, ontological, and political dimensions of such distributed practices. Our interest is thus in how heterogeneous elements are managed and coordinated to produce knowledge in its written form – the "writing" that academics speak about, agonise over, make jokes about, and feel that they should be doing more of (Davies 2021). In analysing distributed writing practices, we develop the notion of "writing choreographies" (building on Cussins/Thompson 1998; 2005). As in the choreography of a dance, writing choreographies consist of movements across space and time following rhythms and patterns that are shaped by aesthetic considerations, and that are planned in advance *and* emerge in the situation. In this sense, our central argument is that writing as an epistemic and ontological practice is carried out by aligning heterogeneous elements in dynamic ways.

One crucial dynamic that shapes contemporary academic writing and agency is that any writing will now be carried out under "post-digital" conditions, by which we mean that distinctions between "digital" and "non-digital" formats, practices, and objects are no longer clear (Jandrić et al. 2018; Taffel 2016). Digital tools and practices cannot be separated from other elements of writing, such as the material devices or particular forms of embodiment needed to use digital tools (Albero-Posac and José Luzón 2021; Tusting et al. 2019). We therefore view scholarly writing as necessarily carried out across diverse devices and equipment, technical infrastructures and their maintenance, forms of embodiment and movement, power and internet supplies, specific arrangements of sites and places, institutional and social conventions, and many other such elements (Waight 2022; Sciannamblo 2019). Relatedly, the boundaries between individual and collaborative writing are increasingly blurred, as commenting and editing text can be done by multiple users simultaneously. Recent technological developments – and in particular generative AI – are also constituting writing in new ways, though these developments are beyond the scope of this article.

Our analysis is sensitised by STS discussions of current academic structures and dynamics, including acceleration and increasing pressure to produce concrete "outputs" such as articles (Ylijoki and Mäntylä 2003; Fochler and De Rijcke 2017; Sigl et al. 2020). With such debates in mind, we trace how agency is constituted and distributed in and through STS writing.

The article thus makes a number of contributions to STS thinking. As well as adding to literature that has examined writing as an epistemic and ontological practice, we build on and develop the notion of choreography (Cussins/Thompson 1998; 2005; Law 2003), using it as a key conceptual device to make sense of how diverse elements are coordinated in writing practices, and highlighting its aesthetic dimensions. We also respond to recent calls to apply the analytical sensibilities of STS to its own epistemic practices (Kuznetsov 2019; Lippert and Mewes 2021), using a group autoethnography to explore writing as a practice that is central to STS knowledge production.

In what follows we discuss literature on scholarly writing from STS and beyond, before describing the study on which we are drawing and our central arguments: that writing is choreographed through the artful arrangement and navigation of "seams" between different material forms of writing and through configuring and "atmosphering" writing spaces, and that writing choreographies as aesthetic ordering constitute agency. In closing we reflect the significance of these findings.

Before we start this more substantive discussion, however, it is worth noting the ironies and tensions of writing about writing. Like the writing that we report and reflect on in our autoethnographic material, this text has gone through multiple iterations and forms. The knowledge claims within it have been transformed over time and as different members of the authorship team have worked on it in its different materialisations (as notes on a flipchart in a meeting, as Word documents stored on individual computers, as Google Docs worked on collaboratively, as paper printouts with handwritten notes on, or as Powerpoint presentations for conference talks). Similarly, the text has taken shape according to (implicit) disciplinary conventions around story, significance, and clarity. While such conventions are not the focus of our analysis – as we discuss below, our attention is primarily on writing as an embodied, material practice – in this regard we want to flag, and acknowledge, our participation in reproducing a particular set of genre norms that themselves co-constitute how and what we can know (Kaltenbrunner et al. 2022).

2. Writing and Knowing in STS and Writing Studies

Writing has always been of interest to STS and its predecessors. While pre-Kuhnian sociology of science focused on the structural conditions of publication processes and the role of publications in the distribution of merit (Merton 1968), historical accounts detailed the development of genres of academic writing and the "literary technologies" (Hoffmann 2013; Shapin and Schaffer 1985) that constitute researcher subjectivities, peer communities, and knowledge claims (Bazerman 1988). Later work explored the material-semiotic practices of producing and distributing text, and how this is involved in the construction of facts: Latour and Woolgar (1986), for instance, framed "literary inscription" as a chain of translations that led from a substance and its manipulation in the laboratory to written texts that circulate in and beyond it, and that constitute the primary outcome of knowledge production (see also Latour 1999). Latour and Woolgar observed how scientists – portrayed as "compulsive and almost manic writers" (1986, 48) – juxtapose, converge, and transform different kinds of text, which then become the actual subject of their efforts. Laboratory studies thus framed writing as implicated in heterogeneous material practices within the lab and writing as performative of the realities it describes (Callon et al. 1986). In the laboratory, "[r]ealities are produced along with the statements that report them" (Law 2004, 38).

More recent research has left the laboratory to, for example, examine the writing of grant proposals (Philipps and Weißenborn 2019) or patents (Myers 1995), the role of text as device in economic experiments (Asdal and Cointe 2022), writing practices in social science methods such as ethnography (Greiffenhagen et al. 2011; Garforth 2012; Jensen 2021; Kilby and

Gilloch 2022; Schindler and Schäfer 2021), and our own writing practices in STS (Michael 2021; Downey and Zuiderent-Jerak 2017; Lippert and Mewes 2021). There is also increasing interest in how writing relates to the politics of the academy, for instance by exploring publication dynamics and how these affect knowledge practices and epistemic cultures (Kaltenbrunner at al. 2022), writing in the context of changing time regimes (Ylijoki and Mäntylä 2003), the role of indicators (Fochler and De Rijcke 2017; Sigl et al. 2020), misconduct (Andersen and Wray 2019), citation practice (Sokolov 2022; Rekdal 2014; Erikson and Erlandson 2014), or peer review (Myers 1985). One striking feature of this body of work is that, while it addresses the effects of changing conditions and dynamics of writing, it engages much less with writing as material practice.

In contrast, the nascent field of writing studies has put the materialities of writing centre stage (Guillén-Galve and Bocanegra-Valle 2021; Prior and Shipka 2003; Johannessen and Van Leuween 2018). Such research addresses the material techniques and digital tools involved in writing (Hynninen 2018; Kuteeva and Mauranen 2018; Tusting et al. 2019; Haas 1996), as well as writing spaces (Dobele and Veer 2019; Prior and Shipka 2003; Tusting et al. 2019; Waight 2022; Powell 2014). Studies mostly focus on students' writing practices, with the aim of finding ways to enable them to write "better", in the sense of efficiency or of following disciplinary norms (Carter 2007). This work has begun to highlight the importance of embodiment and materiality within writing practices (Allen 2019; Muhr and Rehn 2015; Waight 2022) but has been much less concerned with the nature of writing as a form of epistemic practice. While writing is often framed as "a tool for thinking" (Menary 2007), epistemic aspects of writing are rarely present in this literature beyond questions of motivation or being "productive" (cf. Dobele and Veer 2019).

In addressing the epistemic and ontological effects of material practices of writing one key lineage for our research is scholarship on (social science) method. Such work emerges from feminist and decolonial thinking (Haraway 1988; 1997; Bhambra et al. 2018; Muhr and Rehn 2015) and has sought to deconstruct the taken-for-granted authority of "method" (Law 2004; Savage 2013). Accounts have focused on the performativity of writing as one aspect of method, and the ways in which academics should, as writers, consider how to write in ways that are sensitive to the worlds they want to bring into being (Jensen 2021; Lippert and Mewes 2021; Sciannamblo 2019). Importantly, this does not only concern the subjects of research, but researcher subjectivities and how these contribute to academic cultures and practices. STS researchers should attend "not only to what the scholar makes and does but how the scholar and the scholarship get made and done in the process" (Downey and Zuiderent-Jerak 2017, 225). In contrast to early laboratory studies, here the scholar does not appear as a Machiavellian entrepreneur who mobilises text to stabilise facts (Callon et al. 1986; Latour and Woolgar 1986), but as co-becoming with the research and writing process. In this sense attention to method emerges as an ethical and a political question of which worlds (including ourselves and the academic cultures we contribute to) we help to constitute through our research and writing.

For Michael (2021), questions of how research becomes entangled with ontological politics, the subjectivities of researchers, and the wellbeing of different kinds of actors are one aspect of "the research event", a notion which links epistemic, ontological, and political dimensions of

method and writing. Discussing "writing as analysis" (*ibid.*, 139), he explores the epistemic potentialities of writing not only as "concretiz[ing] thoughts that are as yet unformed or immanent" (*ibid.*, 139), but also as "prompting the emergence of a not-as-yet thought, of pushing the analysis in unexpected directions" (*ibid.*, 139). Studies of knowledge production in both experimental set-ups (Knorr-Cetina 1995; Rheinberger 1997) and in the design studio, as a site of aesthetic and material production (Farías and Wilkie 2016), similarly reference the role of surprise and the emergence of new insights in knowledge production. Rheinberger (1997) characterises experimental systems as including both reproduction and difference as a "driving force" for surprising and new observations and questions. Indeed, Rheinberger (2010) argues that for humanities scholars such as himself, writing is an experimental system that at once reproduces thoughts and introduces difference, and thus generates new ideas and insights.

In this paper we build on such discussions of the emergence of epistemic novelty along with writing studies' interest in the material practices and tools of writing and STS concern for the performativity of material-semiotic practices. We start to reflect (and hopefully spark further debate) on elements which have thus far been implicit in STS research on writing, and in particular on the intersection of (digital) writing tools and practices, embodied and encultured academic values and identities, individual agency and affects, and broader structures and expectations of contemporary academia. As described below, we do this by drawing on a collective autoethnographic study of our own academic practices, and by mobilising the notion of choreography to understand these.

3. Studying Scholarly Writing

Writing is widely understood as closely entangled with thinking and feeling. As Garforth (2012) writes in her discussion of "private" or "invisible" knowledge-producing practices, being observed during "solitary thinking work" (*ibid.*, 266) such as reading and writing often makes researchers uncomfortable. Such activities are perceived as intimate and being observed as "intrusive and disruptive" (*ibid.*, 274). As one response to this, in our analysis we draw on an ongoing autoethnographic study that we (that is seven researchers covering different career stages, employment forms, national and disciplinary backgrounds and life situations) have collectively been conducting since February 2021. Within this we write field notes and take photographs, reflect on these in group discussions, comment on each other's reflections using collaborative software, and experiment with creative methods of analysis and reflection, such as drawing our individual writing processes. We trace our practices within and beyond digital platforms and online spaces, and therefore mobilise sensibilities from digital ethnography (Albero-Posac and José Luzón 2021; Beaulieu 2010). Following Pink et al. (2016) we pay attention to a multiplicity of digital and other material practices. While the current corpus consists of some 85 pages of field notes, images, written reflections about these from workshop notes, and Slack messages, the material we draw on in our discussion here has largely emerged from a prompt we used in early 2022 to structure our observations and reflections. This prompted us to collect images and field notes that "reflect how you produce knowledge – how you think, write, and know within your academic work"[1].

Autoethnography can be minimally understood as "biographically opportunistic research" (Anderson 2006, 375). In this case we are certainly able to access experiences and practices around writing that would be inaccessible to external observers, but we also view our individual autoethnographic notes and collective reflections as lively and performative: our accounts "perform themselves into the material world" (Law 2000, 2) and have shaped and re-shaped both our practices and our (collective) reflections on them. The arguments we make in this paper emerged from cycles of coding, discussion, writing, and re-writing and should be understood as being located between us, as authors, and our materials. We draw on the notion of "duoethnography" (Norris and Sawyer 2012) to understand the ways in which our analysis has oscillated between personal and group reflections, and the ways that the boundaries between these are blurred, as "life itself is multi-authored, [...] voices overlap, tangle and become a kind of chorus of experience, sometimes harmonised, sometimes discordant" (Balmer 2021, 1156). Similarly, in this case we can make no clear distinction between "field notes", "analysis" and "writing". Phillips et al. (2022) describe the way in which they combine "thinking with" and "thinking about" their autoethnographic stories, using these simultaneously as analytical approaches and research objects. Our empirical material similarly consists of layers of descriptions, pictures, field notes, interpretations, conversations about field notes, (article) manuscripts, and further field notes.

This is a situated analysis (as all are), and a product of a particular time, place, and collective. In our writing we use the first-person plural to designate a heterogeneous group (in terms of career stage, gender, nationality, disciplinary background, family situation, etc.) with a range of practices and experiences who have, however, chosen to tell a collective story of this research. In doing so, we are not only describing and analysing our writing choreographies but writing our choreographies (into being) and constituting ourselves as researchers alongside our analysis in a particular "research event" (Michael 2021). Our aim is therefore not to give a definitive account of the nature of writing choreographies – and certainly not a universal one; our experiences emerge from a very specific time, place, and set of identities – but to introduce the notion as one means of studying how knowledge claims and researcher identities are made through writing practices.

4. Writing Choreographies as Aesthetic Ordering

An initial observation from engaging with our autoethnographic material was that many of our notes and reflections were concerned with practices that managed particular flows, rhythms, transitions, and spaces. Writing was, as we have already suggested, realised across different material, temporal, and spatial elements. The notion of choreography therefore became a central means for understanding these transitions and how they were managed and mobilised.

In developing this concept, we build on Cussins'/Thompson's (1998; 2005) notion of "ontological choreography", by which she means processes of ordering that relate different enactments of reality through coordinated spatiotemporal movements. She analyses how, in an assisted reproductive technology clinic, a wide variety of entities – body parts that are objectified and treated separately, different technical procedures, legal and bureaucratic

procedures, emotional moments – retain their affiliation to a whole through a choreography of movements which might be distributed in time and space, but which form dynamic patterns. She writes:

> What might appear to be an undifferentiated hybrid mess is actually a deftly balanced coming together of things that are generally considered parts of different ontological orders (part of nature, part of the self, part of society). These elements have to be coordinated in highly staged ways so as to get on with the task at hand: producing parents, children, and everything that is needed for their recognition as such. (Cussins/Thompson 2005, 8)

Exploring choreographies – of writing or anything else – thus affords examination of how the movement and ordering of diverse entities and ontological orders hang together. In the context of our material we are concerned with how the materialities and spaces that form part of our experiences of writing (and enact it in different ways) are coordinated, and how this relates to epistemic and ontological achievements of writing. The achievements we are interested in here are in particular creating new meanings that are accepted as novel contributions to scholarly literature, as well as enacting the scholar who makes such contributions and the research cultures in which the scholar is embedded.

There are two aspects of the notion of choreography that are of special value to our analysis. The first is the way that the notion foregrounds temporality in its focus on dynamic ordering, highlighting, in the context of academic spaces, how different temporal orders and rhythms can shape how specific academic spaces are perceived (for instance as dispersed, interrupted, or continuous) and individual and collective possibilities to act and to produce knowledge (Felt 2016; Hautala and Jauhiainen 2014; Vostal 2013; Ylijoki and Mäntylä 2003). To examine choreographies is thus to explore the temporalities of writing, and to attend to the interplay of speeds that form rhythms through which writing practices are ordered and propelled. The second aspect is the emphasis on spatial movements and their patterns and scopes. Choreographies can be understood as combinations of movement through both symbolic and material spaces: the notion has been used, for instance, to analyse the formation of disciplinary and trans-disciplinary fields and research communities (Moreira 2018; Schikowitz 2017; 2021) or the ways in which seemingly contradictory and dispersed movements constitute new research fields (Molyneux-Hodgson and Meyer 2009; Vermeulen 2018). It therefore calls our attention to the specific spaces (material, digital, or symbolic) that are implicated in writing, and to movements and flows between these.

These dimensions are, of course, not distinct: movement passes through both time and space and consists of (and creates) rhythms and patterns. In investigating writing choreographies, we therefore seek to explore the ways in which temporal and spatial moves blend within particular practices. In addition, we find it important to extend the notion of choreography further, to take into account its aesthetic dimensions. We make use of the affordances of the notion of choreography – a term that in part comes from dance and that refers to the way that an artistic experience emerges from movements through space according to specific rhythms – to consider how (writing) choreographies may be shaped through aesthetic considerations. Aesthetics allows for the creation of coherence in an intuitive and

affective way; "ingredients" are allowed to fit without the need to explicitly spell out the criteria for that fit beforehand (Dewey 2005; Michael 2021). Aesthetic dimensions figured prominently in our autoethnographic materials, which often mention creative and aesthetic practices – such as using colour codes, drawing, or sketching – for handling and ordering written material, and which include reflections on how these were used to create meaning and new knowledge (cf. Hoffmann and Wittmann 2013). Such aesthetic concerns were also extended to workplaces and to the atmospheres we try to create to facilitate writing (cf. Schindler and Schäfer 2021; Prior and Shipka 2003).

According to Dewey (2005), aesthetic experience "fixes attention upon the way things bear upon one another, their clashes and unitings, the way they fulfil and frustrate, promote and retard, excite and inhibit one another" (*ibid.*, 134). Aesthetics thus brings about new configurations that are more meaningful than the sum of their components. In the case of writing practices, this implies bringing about new meanings and knowledges. Similarly, Michael (2021) discusses aesthetics as one aspect of the "research event", something both to be analysed and that is an integral part of analytical practices and methods. Aesthetics, he suggests, is one way of understanding the analytical process, in which we come to "see" or create patterns and achieve a sense of "an aesthetic fit between two classes of ingredient, broadly speaking the perceiver and the perceived (or the researcher and the data)" (*ibid.*, 128).

In addition, while aesthetics is deeply personal and embodied it can also point to broader power relations and cultural norms. Aesthetics as "taste" or cultural habitus (Bourdieu 1987) can be disciplining and exclusive: anything that does not fit into the standards of a certain aesthetic may be deemed ugly or inappropriate. In this sense, reference to aesthetics as a crucial part of choreographies sheds light on how particular forms of exclusion may be realised. Coordinating and balancing various elements in a way that makes them "fit" and become productive is a delicate achievement that depends on the specific conditions, abilities and power relations involved. As Law (2003) states:

> [D]ance *isn't* easy. Rather, it is an accomplishment, a form of work, of effort, of great effort, in a place, with materials that are obdurate. With materials that may resist. With materials that may impose their costs, their own forms of pain. (*ibid.*, 6)

To be attentive to aesthetics within (writing) choreographies is thus to explore both normative judgements and the ways in which aesthetic choices or concerns are involved in situated, embodied, and affective enactments of particular practices. Aesthetics provides a link between pre-scribed (Akrich 1992) movements and rhythms and individual and collective sense-making and affect within a specific situation, operating as a particular mode of ordering (Law 1994). Choreography is thus not only the prior planning of a particular performance, but the emerging performance itself, and the choices made by the performer(s). By paying attention to aesthetics in choreographies as ordering without the need for coherence, we are able to grasp how tensions, dissonance, and surprise (Rheinberger 2010; Farías 2015) emerge within writing practices, how this is performative of new knowledges and identities, and how agency is distributed.

5. Writing as Epistemic and Ontological Practice

In engaging with our empirical materials through the notion of writing choreographies we are concerned with the rhythms of academic writing, the ways in which these are entangled with movements and patterns across diverse spaces, and the role of aesthetics and aestheticising in them. We trace how these configurations and rhythms are coordinated and made sense of through writing choreographies, first by discussing the different materialities of writing and how the interstices and transitions – the "seams" between them – are managed and navigated. Second, we lay out how we compose and "atmosphere" writing spaces and how we move between them. And finally, we attend to the specific relation of aesthetics and agency, and how writing choreographies are entangled with researcher identities and research cultures. For each section, we start with an indicative vignette from our field notes.

5.1 Navigating Seams between Materialities of Writing

> **Vignette 1:** *I am working on a co-authored paper. Sitting at my desk I flick rapidly between different windows: the Slack channel where some of our notes are sitting; the Google Doc this version of the paper is in, with its plethora of notes and edits; screenshots and images on my desktop; and Word, the programme I usually write in. "Have you finished editing for now?", I ask (via Slack) the colleague who, as I can see in the Google Doc (and who I know is sitting two offices down the hall; we just had lunch together), has most recently been adding comments and text. At the same time, I copy and paste one Slack thread into Word, then print it out – emojis and all – so that I can read it through in hard copy and take handwritten notes. Then I download the Google Doc as a Word file, putting a stop to this form of collaborative writing for the moment. I need to read the notes on paper, then think about how to integrate them by editing in Word. Only then will I again upload the text to Google Docs where the others can comment. In practice, this is what my work looks like much of the time: I am emailing and working on Word documents and checking my calendar and scanning pdf papers and much else besides, all fairly seamlessly or without noticing the gaps between these different tools. They all afford different ways of thinking or working (why, for example, does it feel different to write in a Google Doc than in Word?).*

Similar to other aspects of our material, this vignette highlights how writing is enabled by the dynamic coordination of different materialities (cf. Ince et al. 2022; Schindler and Schäfer 2021; Haas 1996) which afford different ways of thinking and working. We understand materialities of writing as a specific constellation of writing that includes tools, the researcher body, affects and identity, and specific knowledge. What emerges from the vignette above, and from our autoethnographic material more generally, is a concern for careful selection of the right materialities for different tasks and purposes, at specific moments and places, and for the skilful composition and coordination of these to yield epistemic gains. This, of course, presupposes access to and the ability of using all kinds of tools and infrastructures, which is not self-evident for all researchers and often requires personal effort (see Davies et al. 2022). The diverse materialities of writing are therefore not static but must be constantly coordinated and arranged. Different materialities of writing need to be made compatible,

and, importantly, the gaps and seams between them need to be managed and navigated. For instance, elsewhere one of us describes the routinised bodily movements necessary for creating the experience of "seamlessness": fingers flicking over the touchpad and typing shortcuts on the keyboard, moving between different tabs and windows on the screen, and transferring information between different devices by using online clouds and platforms. It is only when their routines are disrupted – for instance by a plaster on a finger that slows their typing, or by a new laptop where buttons and apps on the desktop are ordered differently – that the different materialities and affordances of these digital modes, and the routinised bodily and mental movements that are necessary to bridge them, are made recognisable.

While the vignette and description above involve rapid and straightforward transitions between different platforms and aspects of the writing process, we also find that the mobilisation of "seams" – points at which different infrastructures "collide" and where actors must therefore "make connections and bring disparate elements together" (Vertesi 2014, 268) – may be used to aid epistemic production. Other accounts indicate that we (purposefully) exploit seams between different materialities of writing for epistemic gains. One indicative example is the paper notebook and the role of handwriting. These play a crucial role in our writing practices but are used in very different ways (cf. Waight 2022; Hoffmann 2013): they can be places for collecting messy ideas and notes, for organising tasks and writing lists, for remembering well-elaborated arguments, or for externalising messages to ourselves. In whatever ways we use our notebooks, however, they feel close to our bodies and thinking. Handwriting cannot be easily altered, and writing in them therefore gains a certain authenticity and intimacy – also indicated by our reluctance to let others see our notes. The aesthetic and tactile appearance of the notebooks and the pens we use to write in them also play a role, giving rise to different moods, subjectivities and ways of writing and thinking.

Transferring handwritten text into digital writing notably takes more effort than copy-pasting text or transferring it from one digital platform to another. One set of field notes describes in detail how the author regularly goes through their paper notebooks and transfers "all important thoughts and ideas" into digital formats, in a way that aids their reflection on those ideas. It is the re-ordering of text as it travels between different materialities, and the slowing down of the workflow that this implies, that is productive for re-arranging thoughts and ideas and thus for creating knowledge. In this sense, navigating different materialities of writing involves translations between them, each of which causes small shifts in meaning, or "betrayals" (Law 2003), and creates something new. Each platform, device, or writing mode affords different ways of thinking, and alternating between them can contribute to the emergence of new knowledge. Farías (2015), in the context of architectural design, refers to this as "epistemic dissonance" between different "material mediators" of an outline, which is key to the emergence of new ideas and alternative designs.

In this way the skilful navigation of the diverse materialities through which writing is realised might not (always) strive for seamlessness but does seem to mobilise the affordances of diverse formats and the seams and dissonances between them in order to find rhythms and patterns that result in new knowledge. Writing choreographies are also distributed between humans and non-humans, and between the material affordances of certain tools and devices and our ways of using them. It is, in part, the artful management of this distribution that allows for epistemic novelty to arise.

5.2 Atmosphering Writing Spaces between Mess and Order

Vignette 2: *In pandemic times in [country], I write best from my home office, a.k.a my dining room table, where everything is arranged just so, protected from the disorder of the rest of the apartment and family life. The floor is protected by an old bath towel so that the chair – which I have stolen from my son's desk, as he left it unguarded – will not scratch the floor of our rental apartment. The table is protected by an orange napkin from potential water rings and discoloration which might be caused by the running supply of tea and water which I drink while I write. My tablet and notebook are neatly organised, ready to help me sketch ideas which are just better as pictures or diagrams, and my noise-cancelling headphones are fully charged to muffle the noise from my partner's calls in their home office, a.k.a our bedroom. My writing practice is also protected. I close all messaging apps – WhatsApp, Slack, mail, Twitter, anything which might "ding" and distract me from my flow. I close the doors to the dining room, sometimes putting a hand-drawn picture of an animal on the door with a speech bubble saying "Shh...I am on a call." (I have learned that saying "Shh...I am writing" is not as effective at keeping my children out of the room.)*

Vignette 3: *In my office, piles of paper (articles, printed versions of manuscripts, notes etc.) are "growing" over my shelves and my desk. The piles are marked and separated through post-its and sort pockets in somewhat unsystematic and chaotic ways. On my desk, some books I recently used, my notebooks, and teaching materials, as well as boxes with pens and office supplies, occupy the sparse free space, which leaves barely space for my laptop. In my laptop, the mess continues, with several tabs open in my browser which contain papers I want to look at or ideas I still need to follow up on. But actually the messiness of that can be productive, too. For instance, when I am looking for a specific article for teaching and need to go through a whole pile (or more) for finding it, I might accidentally stumble over other texts which spark new ideas for one of the writing projects I am working on. Thus, the inefficiency of the system facilitates contingent and serendipitous encounters. It contributes to my thinking and writing – new connections are made, new ideas come up and some observations suddenly make sense.*

These two vignettes – representative of several accounts from our field notes describing different writing spaces – show how, by choosing and composing different materialities of writing by in- and excluding a range of things and persons, we configure our writing spaces and their specific atmospheres. This involves adjusting and (re-)arranging a whole range of things: furniture, drinks, devices and tools, noise, family members, software, printed articles and books, and notepaper. This arrangement is maintained through technical as well as social and organisational means: turning off notifications and wearing noise-cancelling headphones, closing doors, and drawing signs that keep others out, using sticky notes or tabs in a browser to allow for a loose coexistence of materials.

The vignettes show how mundane practices participate in aestheticising our writing, and thus in the process of knowledge production. Our argument here is that arranging writing spaces does not only give rise to a motivational or productive atmosphere in which we write well (cf. Waight 2022; Schindler and Schäfer 2021; Prior and Shipka 2003), but that constituting a writing space at the same time enacts writing practices, knowledge production, and researcher subjectivities. In this regard we find the term *atmosphering* (Göbel 2016) useful to

address the fragility and ambivalence of atmospheres, and the necessity of constantly maintaining or reinvigorating them. Atmosphering creates "situated capacities of mediating the desired atmosphere, which maintains a certain potential to crowd out others and develop an agency of its own kind" (Göbel 2016, 172). As such, materiality and bodily experiences are a crucial part of creating writing spaces, and something that is repeatedly referenced in our field notes.

Vignette 2 presents an orderly and protected space, indicated by terms like "neat" or "clean", where the furniture is protected from damage, the workplace is protected from disorder, and writing practices and the writer are protected from disturbances. Creating a protected writing space means gathering everything which is needed for the writing situation (tea, notepaper, laptop, the writer), and excluding everything else (family members, noise, emails). In this case, a protected writing space co-becomes with the solitary, focused writer as a thinker and the systematic knowledge that draws together elements to compose a well-founded knowledge claim. In contrast, vignette 3 describes a messy writing space that includes and maximises contact with all kinds of external impressions. Here the writing space appears as crowded with elements that do not belong to a specific writing project. It is a repository, an archive layered with the remains of past and current projects, which spills over to the writing task at hand. Here, the messiness and the coincidental juxtaposition of texts sparks a creative atmosphere that redirects intended connections and allows new relations to emerge, shaping thinking and writing and leading to new ideas. The writer that co-becomes with the messy writing space is a creative scholar, who gets easily distracted by accidental observations, which however spark ideas and ingenious insights (cf. Michael 2021). The knowledge which is thereby created is innovative yet raw and in need of systematisation and streamlining.

Our materials show that particular individuals do not stick to one such writing space (although they may have preferences), but that in our writing choreographies we strategically create and alternate between different (protected or messy) spaces for different writing purposes (cf. Tusting et al. 2019). As one of us describes:

> If I were working on a reference list, I would be drinking a double espresso at Cafe X and watching the daily market out the window. If I were intently writing, I would be at the library cafe, where I could be surrounded by mostly hard-working students and be kept awake by my uncomfortable wooden chair.

By conducting different kinds of writing in different surroundings, the writer actively seeks different sensory experiences that might provoke specific moods, bodily affects, subjectivities, and ways of thinking. Importantly, the degree of freedom to choose and equip appropriate writing spaces for "managing the body to allow it to do this thinking work" (as one of us phrases it in their field notes) is often related to privilege and to the availability of financial resources to choose appropriate furniture and to write in commercial spaces, or to independence from care or occupational obligations. When choices to shape our writing spaces according to our needs are very limited, this might obviously hinder the emergence of dynamic writing choreographies, and thus knowledge production. It speaks to the idea that experiencing and pursuing our writing spaces always happens against the backdrop of the positions we occupy within different orders and power relations (cf. Tusting at al. 2019). It is therefore important to consider how our "aesthetic experience" (Dewey 2005) is situated and relational.

Atmosphering is a crucial element of our writing choreographies: it does not create a single, fixed writing space, but is ongoing and malleable. Different writing spaces not only motivate us to carry out different tasks; more than this, navigating and balancing protected and messy spaces in specific ways is co-constituted with researcher subjectivities as systematic *and* creative, and our knowledge claims as novel *and* well-founded (cf. Rheinberger 1997). Navigating these spaces in specific choreographies is therefore performative of how we write, who we are as researchers, and what knowledge we produce. This onto-political dimension of aesthetics, and how aesthetic ordering is both an expression of individual idiosyncrasies, collective becoming, and current academic norms and cultures, is further addressed in the following section.

5.3 Aesthetics and Agency between Efficiency and Intimacy

> **Vignette 4:** *In writing together, the two of us met once, in person, to discuss our plan and then just ping-ponged our draft via Google Docs. I was pleasantly surprised how efficiently this worked; in terms of synchronicity, it felt as though I was in direct dialogue with them via the platform. At some point, our rhythms seemed to converge and we worked on the document at the same time. Sometimes, we would even tweak and fiddle around with the same sentence, still it felt really easy going and effective, as though we were thinking together. Either we were really perfectly synced, or Google had made some improvements to the platform, but not even the problem of "slippery text" (where one writing partner deletes or adds a section and the text below suddenly bounces up or down while the other writer works on it) occured. Without explicitly coordinating we seemed to perfectly harmonise during the editing process. Even though we were physically distanced, I felt close to them during the whole process. So, relating my engagements with co-writing in Google Docs to verbal discussion, I find that Google Docs alleviates some of the time(-ing) pressure that comes with conversation. I noticed that I find the possibility to revisit and edit my own comments and suggestions very calming. In this way, I can find my own flow, making my own rhythm.*

Collaborative writing figures prominently in our material. Writers create co-presence (Beaulieu 2010; Ince et al. 2022) in digital spaces through writing-oriented Zoom calls (where writers sit with their cameras off, working on the same writing project together), working on Google Docs at the same time, as described in the vignette above, or using messaging services such as Slack. The technical affordances of particular platforms for collaborative writing are key to this (cf. Hynninen 2018) – and it might seriously hinder collaborative writing if they don't work as expected. Platforms such as Google Docs are another space to be atmosphered as writers work together on texts and find "synchronicity" in how they collaborate. The vignette above addresses one such instance in which co-writers succeed in creating an atmosphere that allows for both "making my own rhythm" and "perfectly harmonis[ing]". Here the two co-writers and the relations between them, their working customs and affects, and the technicalities of a platform that allows for simultaneous writing in the same document all contribute to a common rhythm and atmosphere that allows for "thinking together". That such a delicate coordination between people and platforms works well is not obvious, and involves skill, luck, and the production and management of particular affects.

The vignette particularly points to the ways in which seeing the other write and think, and the conversations into which interlocutors enter through editing and commenting, creates a shared space with a specific atmosphere, one that allows for intimacy and trust. The proximity kindled by this atmosphere might be enjoyable in a trusting relationship, while in a different context such exposure might induce vulnerability (something we also find in our material). Including others in our writing spaces, letting them see our unfinished, raw, and messy writing, and exposing ourselves to their reactions implies showing them our fragile researcher identities. For instance, if collaborative writing tools are not available or do not work as intended, or if colleagues disagree about the rhythms and aesthetics of the common workflow, the choreography can fall apart. In that sense, choreography includes not only the mastery and coordination of tools and spaces, but emotional work and the need to balance frustration and anxieties emerging from collaborations. Attending to the intimacy of writing thus shows how closely writing choreographies are entangled not only with epistemic processes but with researcher subjectivities, agency, and identity formation – both relating to individual researchers who develop a sense of who they are as researchers through writing, and to collaborators and research groups who develop togetherness as they write together.

The momentum, the common thinking which emerges from co-writing, can be regarded as another way to introduce variation and surprise into the writing process (cf. Rheinberger 1997) and thus to create epistemic gains. As collaborative writing is becoming more common some of the techniques and technical means that support it – such as having conversations within the text via comments and tracked changes, and the atmospheres that these help produce – also inspire new, individual writing practices that allow new ideas to emerge from (auto-)conversations within the text. The increasing co-presence of others in our writing spaces and the common rhythms which emerge shape the atmospheres not only of these spaces, but also of individual writing, as the boundaries between individual and collaborative writing become blurred through new technical means.

Vignette 4 highlights not only the intimacy of the co-writing process, but notions relating to its efficiency and effectiveness. Here and throughout our material "efficiency" – in the sense of a smooth process without unnecessary delays or conflicts – is often framed as a goal. Such references hint at the moral connotations of certain aesthetics in contemporary academic norms, and expectations regarding how to be a good researcher. In the field notes we all invest time and effort into "organising my time and thoughts" (for example by creating lists and tables), describing these as crucial for being able to write and produce knowledge in the first place. At the same time, we also find the sense that messiness and "ineffective" processes that include detours and delays are valuable for writing, and that messy processes give rise to contingent and surprising ideas and allow us to make new connections between elements (as mentioned in vignette 3).

While we acknowledge the epistemic necessity for mess and inefficiency, our field notes include feelings of embarrassment, guilt, and concern at being haphazard, messy, or impulsive (cf. Muhr and Rehn 2015). This might be further exacerbated when occupying specific positionalities, like not being an English native speaker, having been socialised in a non-STS discipline, neurodiversity, or other sources of stress. The current academic regime, with its moral and aesthetic "script" (Akrich 1992) towards efficiency, acceleration, and "productivity", is thus understood as being in tension with writing as a creative and intimate practice.

In practice, however, we found that order and mess, efficiency and delay, mostly blend into each other. Playing around with messy text elements can lead to new orders, and sometimes ordering practices lead to mess. To exemplify the first, our field notes include various descriptions of writing as assembling text elements from notes, literature, feedback, and empirical materials and fiddling around with these elements – "like children in a sandbox" as one of us describes it – until a serendipitous pattern, a new order emerges. Vice versa, one of us describes how joy about the "neatly ordered categories" of a literature management program can lead to "fiddling around with it for so long that I completely forget what I was looking for in the first place", or how repeated attempts to develop a perfect file system end up in "pure chaos" because it does not fit the messy working modes in practice.

These examples demonstrate how despite the moral urge towards efficiency and order, mess and contingency slip in. Ruptures, seams, and dissonances which slow down efficient workflows, and which urge us to re-order and think things anew, making new connections, might be less efficient, but are epistemically generative (cf. Rheinberger 1997). The back and forth between mess and order, delay and efficiency, and the writing choreographies this gives rise to make writing an epistemic practice and enact writer subjectivities that may be more or less in tension with those that emerge from current regimes of academic governance (Sigl et al. 2020). Agency is thus not merely determined by the "script" (Akrich 1992) of single tools but emerges from atmosphering and the use of different tools in specific ways in individual and collaborative writing. These individual combinations of tools, writing practices, and aesthetics intermingle with those of current academic regimes within writing choreographies.

6. Conclusion

Deploying the notion of writing choreographies on material from an autoethnographic project, we have discussed the ways in which academic writing in STS unfolds as a distributed practice, coordinated through dynamic patterns that emerge from the alignment of different materialities of writing, writing spaces, and aesthetics. Writing, we have shown, is choreographed through the artful arrangement and navigation of "seams" between different material forms of writing, and through configuring and "atmosphering" writing spaces. We further argued that agency within writing is related to aesthetics and to interplays between intimacy and efficiency. Ultimately, we have suggested that writing choreographies enact new knowledge as well as individual and collective researcher subjectivities and research cultures.

In this way, the concept of "writing choreographies" does not only allow us to understand knowledge production, but also offers a lens to analyse researcher identity and positionality, and in particular how exclusion of certain forms of writing or individuals from post-digital writing may take place. As we have seen, it is necessary to master and align different materialities, tools, and spaces in complex and delicate ways to successfully perform writing choreographies, as well as to balance current norms of efficiency with creative leeway and personal needs. This might not be possible for those who lack access to certain tools, do not possess the privilege to aesthetisize their writing spaces in ways that meet their demands, or whose positionalities do not allow them to introduce creative rhythms and orders. While our materials emphasise

the epistemically generative, satisfying, and community-building aspects of writing choreographies, it is not self-evident that such distributed post-digital writing results in improving knowledge and togetherness. Furthermore, choreographing divergent elements is not always a joyful experience. It can also be extremely frustrating, annoying, and accompanied by anxieties.

While these observations are based on situated empirical experiences and emerge from a very specific time and location, we suggest that the concept of writing choreographies could have more general applicability, and that it would be valuable to explore these alignments of different materialities and spaces in post-digital writing in other contexts, for example in different disciplines or research traditions. Paying attention to aesthetics as a crucial aspect of academic practices and writing choreographies allows us to understand knowledge production and epistemic cultures as emergent, and to see agency as both determined and as changeable.

In this regard one central implication of our argument relates to current debates around academic publishing dynamics concerned with increasing output pressures (Ylijoki and Mäntylä 2003; Fochler and De Rijcke 2017; Sigl et al. 2020). Our analysis suggests that writing choreographies are both structured by (and reproduce) larger developments, such as demands for efficiency or productivity, and by researchers' own agency and identity work. They are infused with moral expectations concerning how one should work – efficiently, productively, in an organised manner – and thus enact neoliberal selves. However, simultaneously they enable the formation of new, caring relations between co-writers, or allow for positive valuations of mess and disorder. The notion of writing choreographies thus emphasises not only the ways in which agency emerges through the back and forth between different materialities and spaces, each with their different affordances, but the entanglements between epistemic novelty, researcher identity, and the material practices of research. As such it provides one frame for examining how we, as STS researchers, are "made and done" in our research (Downey and Zuiderent-Jerak 2017).

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Authors Contribution Statement

Andrea Schikowitz is the corresponding lead author of this paper. Esther Dessewffy and Sarah R. Davies contributed equally and share the second author position. Bao-Chau Pham and Kathleen Gregory contributed equally and share the third author position. Elaine Goldberg is listed as the fourth author. Ariadne Avkıran and Fredy Mora Gámez contributed equally and share the fifth author position.

Notes

[1] The full prompt was:

« Over the next weeks:

- Take 3 (+/–) photos that reflect how you produce knowledge – how you think, write, and know within your academic work.
- Write fieldnotes or text fragments (1000 words, +/–) that respond to these images. Consider (for instance):
  - What digital tools, platforms and technologies are implicated in your academic work?
  - How do you use these, and how do they relate to "offline" practices?
  - Where are these (digital) practices respectively located physically? Are there certain places where you conduct certain kinds of work or certain knowledge practices?
  - What rhythms, temporalities, and flows are involved?
  - What other activities or practices are involved in academic work, aside from "knowledge production"? What does this even look like in STS? »

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