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Mapping and tracing the postdigital

Mapping and Tracing the Postdigital: Approaches and Parameters of Postdigital Research

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Abstract

The launch of *Postdigital Science and Education* helped generate a burst of new scholarship about this emerging turn in educational research and theory. Yet, what it means to do postdigital research remains obscure to many. Ongoing debates around definitions, combined with the complexity of analysing digital activity within rich contexts that are also social, material, political, economic, and so on, make it challenging to understand what constitutes postdigital research. Meanings of the postdigital emerge from within the processes of postdigital research. Furthermore, while some individual contributions to postdigital research may be grounded in particular disciplines, we argue that postdigital research, in general, benefits from transdisciplinary knowledge. All of this points to a need for flexibility, and principled, rather than prescriptive, research and scholarship practices. It situates postdigital research in the tradition of compositional and inventive research approaches, and this paper traces that relationship.

Keywords Postdigital research · Sociomaterial · Speculative methods · Compositional methodology · Epistemology · Post-qualitative

Prologue

This paper is co-authored by teachers and students of a pilot course within the postgraduate Education Futures programme at the Edinburgh Futures Institute at the University of Edinburgh.[1] The course, Postdigital Society,[2] introduced

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[1] See https://efi.ed.ac.uk/education-futures/. Accessed 2 December 2022.

[2] See http://www.drps.ed.ac.uk/21-22/dpt/cxefie11012.htm. Accessed 2 December 2022.

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students to postdigital conceptions while they simultaneously produced exploratory postdigital analyses of technology-related topics (e.g. an Alexa EchoDot, employee monitoring software, the technological configuration of the course). Rather than starting with pre-set methods, students collaboratively identified, developed, and combined methods through trial and error and dialogue. Through this, we discussed what makes an analysis 'postdigital' and played with creative ways of exploring the relations between digital and non-digital.

In this paper, we reflect on our experiences of the course (including verbal and online discussions, work produced for assignments, and teacher and peer reviews of that work) to distil some key methodological considerations for postdigital research. We ask how postdigital research connects to, and is distinct from, other approaches that understand technology as entangled with the social and material (e.g. sociomaterialism or philosophy of technology), and from other 'post' traditions (e.g. post-modernism or posthumanism). We then consider what constitutes quality in this kind of research and what principles might inform future postdigital research.

Introduction

The term 'postdigital' is multifaceted. It might characterise a societal condition, an approach to research and critical enquiry, or a theoretical perspective, sensibility, or philosophical position. Sinclair and Hayes (2019) discuss the work that the prefix 'post' does in relation to the object that is 'post-ed' (e.g. 'modernism' or 'humanism'), proposing that it may serve most usefully as an indicator that its object is in need of questioning. 'Posts' need not be proposals that we are now past something (modernism, humanism, or 'digital') in a historical sense—indeed, digital and postdigital must co-exist for the latter to have currency. Rather, they can be proposals that a critical view be taken up as to what these terms mean in relation to the past, present, and future. For example, for Knox (2016: 31), the 'post' in critical posthumanism is about destabilising humanism, questioning its incontrovertibility.

At its simplest, a postdigital perspective is a rejection of digital as independent of material and social activity (Fawns 2019), or of political, economic, biological, and environmental factors (Jandrić et al. 2018). Digital activity is always realised through material means and is always embedded in the world. For example, a postdigital research approach to education may consider how the digital activity of EdTech platforms is woven into broader material, human, political, economic, environmental, and biological interrelations at institutional and societal levels. The postdigital can also be a way of seeing the continuation of digital as it is (always already) embedded in the world. For Cramer (2015), for example, it is unhelpful to think about digital outside of its forms of hybridity with analogue. Peters and Besley (2019), Jandrić et al. (2018), Fawns (2019), and others have described postdigital as a philosophical position, theoretical perspective, or sensibility, in which digital is inseparable from the non-digital world.

A core premise of the postdigital, for us, is to challenge established ways of understanding digital technology. This includes questioning what counts as an 'evidence base' and how we might generate new kinds of knowledge. We also see postdigital research as not just interdisciplinary but transdisciplinary (Jandrić and Knox 2022). If different disciplines have different views on what counts as research (not to mention variance within disciplines), how do we negotiate transdisciplinary postdigital research?

Our writing of this paper, and the postgraduate course on postdigital analysis that brought us together, involved a productive negotiation of ideas between people of varying disciplinary backgrounds (including Philosophy, IT, design, journalism, digital education) and research experience. There remain definitional and epistemological debates within our team of authors. In many contexts, this could be a significant barrier to collaboration. We do not believe that to be the case in postdigital scholarship (at least, not yet), where there is scope for generative debate around productive frictions and tensions. Indeed, the dissonance between our different backgrounds and perspectives has informed our argumentation. Thus, we argue for the potential value of multiplicity, and for holding open, within certain parameters that we discuss below, the definitions and criteria of postdigital research and scholarship. We have tried to be inclusive of different views, in the hope that what we present is an account of ways forward that welcome, rather than close down, possibilities for different kinds of contributors and contributions to postdigital research.

The paper is written by a team of people who were involved in a 5-week, 10-credit pilot course called Postdigital Society that ran as part of an Education Futures postgraduate programme within the Edinburgh Futures Institute at the University of Edinburgh. Tim Fawns designed and ran the course; Jen Ross was the Programme Director and a peer observer of the learning and teaching activity; Joe Noteboom was a teaching assistant and PhD student; Henrietta Carbonel, Sam Finnegan-Dehn, and McKenzie Raver were students who accepted a class-wide invitation to contribute to this paper. In January–February 2022, 12 students took part in the pilot course, which was run asynchronously, punctuated by a 2-day hybrid 'fusion' workshop in the third week (i.e. half-way through), during which students elected to take part remotely or from within an on-site classroom in Edinburgh.

Throughout the course, students worked in groups, and individually, to develop and try out methods of analysis for a range of technological objects or practices. Some initial ideas of digital items that could be studied were offered to students (e.g. an Alexa EchoDot, a FitBit), and these were expanded by students through discussion to include employee monitoring software, the Miro online whiteboard used for collaboration within the course, and more. The aim was not to do postdigital research on these objects but to explore what it means to take a postdigital view of them, what kinds of information might support such views, and how we might generate that information. Our explorations were guided by the course design, resources, and facilitators (Tim and Joe), but they were also student-led, with student groups discovering and designing their own ways of *potentially* conducting research and analysis on postdigital objects. Through a combination of trial and error and dialogue around what makes an analysis 'postdigital', students and staff played with creative ways of mapping and tracing the relations between digital and non-digital.

Henrietta, Sam, and McKenzie contributed to the paper by offering written comments which were incorporated into a draft paper by Tim, as well as offering comments on the writing as it progressed. Jen and Joe contributed with comments, edits, and passages of writing. Together, we consider our experiences of this course to distil some key methodological questions for postdigital research. In this, we take care to navigate paths forward that remain open to a diversity of disciplines and perspectives, since we see interdisciplinarity and collaboration as key to the potential value of the postdigital, as evidenced by the *Postdigital Science and Education* journal and the efforts of its editor, Petar Jandrić (Jandrić et al. 2019; Jandrić and Hayes 2019).

Different Lenses of a Postdigital View

Different ways of defining 'postdigital' were available via a list of course readings and their own literature searches, and students could repurpose these definitions in relation to their interests. They were encouraged to make their conceptions explicit, along with the implications for their area of inquiry. An aim of the course was that, however students conceived of the postdigital, it would help them to locate technologies in complex contexts, emphasise assumptions in need of questioning, and reveal absences and invisibilities (e.g. regarding datafication, determinism, imaginaries, rhetoric, surveillance, or ideology).

Sam, for example, understood postdigital as a method of surfacing relations between 'man and machine' that we often become accustomed to, without appreciating the complex results. For McKenzie, postdigital was a critical perspective that highlights the messy and unpredictable nature of technological integration and its relationship with humanism, posthumanism, physics, and biology. For her, a postdigital view captured a merging of old and new and was 'both a rupture in our existing theories and their continuation' (Jandrić et al. 2018: 20). It was a way of seeing pervasive, covert, and less visible power structures, for instance in the increasingly reliant relationships with virtual assistants like Alexa. For Henrietta, postdigital inquiry entailed a sociomaterial view in which digital and non-digital not only shape each other in reciprocal and non-linear ways, but co-constitute a broader assemblage. An analogy might be that the activity of the arm is not merely shaped by the activity of the leg; both are co-constitutive parts of a greater, dynamic body. These different perspectives show that conceptions of the postdigital are still ripe for negotiation.

This is both liberating and challenging for researchers. Yet all three of these perspectives have important commonalities: they can help us look beyond the hype, risk, harms, and benefits of new technology, while also making visible technologies, processes, and practices that have become so familiar we no longer notice them. They can help us interrogate assumptions that stem from binaries or dichotomies between people and technology, digital and non-digital, online and offline, etc. This suggests to us that postdigital is not a theory or epistemology but a sensibility or a way of looking.

As students worked in groups on their analyses, they negotiated differing concepts while trying out methods of collecting, analysing, discussing, and sharing data with the aim of generating a range of connections. In social science research, creative methods are increasingly understood as necessary to grapple with the messiness

of the social world (Law 2004), and the emergent and entangled nature of postdigital inquiry seems to us to be suited to methods that are flexible, imaginative, and inventive. Students tried out thought experiments and hypotheticals (e.g. a day in the life of a particular technology; what would happen if the object of analysis ceased to exist; how could a technology's functions be thought of differently?). They took up speculative points of view (e.g. taking the point of view of the technology—how does it see/influence the world?). They dabbled in metaphors (Lakoff and Johnson 2003; Weller 2022), storytelling, and speculative fiction (de Freitas and Truman 2020). The aim of speculative approaches was not to propose solutions, or artefacts to be made, but to ask questions and to 'debate potential ethical, cultural, social and political implications' (Dunne and Raby 2013: 47). They allowed students to consider hopes, dreams, fears, or concerns about new technologies and to question underlying assumptions (Ross 2017: 219).

A range of other design approaches also contributed to the ideas for postdigital analyses generated during the course, including design scripts, prototypes, or storyboards (St. Amant 2017); journey mapping (Howard 2014); interaction mapping; personas (Miaskiewicz and Kozar 2011); and explorations of subversive uses (e.g. using performance monitoring software to surveil leisure activities). Visualisation methods such as mind mapping (Wheeldon and Ahlberg 2019) and empathy mapping (Siricharoen 2021) were employed. Alongside these were established research approaches, such as interviews, surveys, (auto-) ethnography, and observation, as well as newer, participant-informed approaches such as crowdsourcing (Estellés-Arolas and González-Ladrón-de-Guevara 2012). There were suggestions for document and data analysis, database searches, Internet searches, corpus or thematic text analysis, and image analysis. Theoretical frameworks and models were proposed for looking at empirical data through different lenses. Examples included Freire (1996), Orlikowski (2007), Gaventa's (2006) 'power cube', and the Political, Economic, Sociological, Technological, Legal, and Environmental (PESTLE) framework (Aguilar 1967).

Despite the small class size, a significant range of approaches were raised and considered, and this provided a rich basis for examining what it might mean to conduct a postdigital inquiry. Each method had the potential to show relations between digital activity and its social and material contexts. These relations represented possible paths for closer analysis. Even the simple generation of lists of connections could powerfully illustrate the extent to which any digital technology or activity is intertwined in our lives, or the extent to which digital technology, more broadly, is pervasively intertwined in society. Simply by discussing methods that could be used for analysis, we discovered ways in which one technology is related to another and the problem of trying to exclude certain types of digital activity when discussing others.

As helpful as these methods were, individually, it was in their combination that a richer sense of postdigital entanglement could be seen. Some interesting work involved combining ideas from different disciplines: a philosophy student took a creative writing approach, and a design student situated storyboards in philosophy. Crossing disciplines was also collaborative: students from different fields approached topics together, blurring boundaries and stretching our collective understandings of the postdigital. In this context, the question of what 'counts' as research became contested and complex.

Mapping and Tracing the Postdigital

In developing their proposals for postdigital analysis, students first negotiated—with prompts from teachers where needed—what they cared about in relation to a technology and what they wanted to know about it. Through our course conversations, we saw that this often involved moving focus from objects to practices involving the object (e.g. from an Alexa EchoDot to particular kinds of interactions with their instantiation of the entity, Alexa). However, identifying an initial technology is not always straightforward. As Knox (2019: 280) points out, 'the digital is so intimately entwined in our lived experiences and institutions that to set boundaries around some gadget or device seems somewhat arbitrary'. Technologies are always made up of multiple elements (Dron 2022) that are situated in particular use contexts (Kanuka 2008). For example, the Amazon Alexa EchoDot is an assembly of microphone, speakers, power source, Wi-Fi, software, AI, security protocol, cloud architecture, and more, and it manifests differently for different users in different settings. In defining the initial object of analysis, students needed to identify what combination of technologies in use mattered to them and how this combination was embedded in wider cultures, systems, and contexts.

From there, these initial foci were expanded through creative and speculative mapping processes, to locate them in larger territories, made up of known and unknown elements. Metaphors of tracing and mapping from Deleuze and Guattari's (1987) rhizomatic philosophy can illuminate questions of method, traditions, epistemology and ontology, inclusivity, and dialogue. Mapping and tracing are different, but not mutually exclusive, ways of locating technology and technological practices in complexity. Mapping involves 'experimentation in contact with the real' (Deleuze and Guattari 1987: 12) to create ideas that can be torn up and rethought, and where any kinds of connection are possible. Tracing, on the other hand, consists of investigative methods (rather than the more speculative or generative methods of mapping) to examine and represent a phenomenon.

Mapping is a creative process that expands the possibilities of what can be thought about, and of seeing things in new orientations, beyond established disciplinary constraints. An example from our course was thinking about an employee monitoring software implementation as part of a neoliberal employment landscape and then considering other features of that landscape, such as surveillance culture, unions, technology companies, and government regulation. By exposing new possibilities, this helped students to speculate about what could be relevant within a particular framing of this technology. From there, they could consider how these different elements were related and entangled. Such maps are not fixed, and not designed to find specific locations, but to continue to find new things (Wang 2015).

A challenge for students was to navigate the limits of their mapping: where and how to draw boundaries around their proposed methods. If everything is entangled, where should one stop tracing and mapping entanglements? For Barad (2007), from a sociomaterial view, in which different elements are co-constitutive parts of holistic assemblages, determining what is inside (and, consequently, what is outside) of the scope of inquiry requires 'agential cuts'. These are explicit or implicit choices

around what is relevant and feasible to include in any appreciation of complexity, where the entanglements are potentially infinite. We cut, and we acknowledge the violence that this does to our understanding of objects in the world.

Cutting is also a necessary part of the negotiation of mutual understanding with others. In thinking through a proposal for postdigital analysis of employee monitoring software, for example, students considered how they might present a bounded object of analysis to which policymakers could relate. Such cuts suggest the potential value of focused questions or other ways of guiding decisions about scope and relevance. However, we also see value in encouraging creative possibilities, under more flexible and long-lived circumstances, of expansive and free exploration. This is a tension between tracing and mapping: the former is grounded and constrained, and the latter is abstract and free.

Tracing, by drawing on established measures, procedures, frameworks, and forms of observation, is constrained by pre-existing structures and conceptions. In our course, tracing was part of testing out proposed methods through closer examinations of how technologies were implicated in actual and possible activity at different levels of abstraction (e.g. at personal, group, institutional, or societal level). For example, students sometimes proposed methods of quantitative data collection and analysis, or interviews or ethnographic observation of day-to-day interactions with technology. Deleuze and Guattari (1987) warn that, by relying on pre-known, codified ways of thinking and doing, tracing reinforces entrenched ways of understanding. Referring to their rhizomatic logic, they argue that tracing merely shows 'impasses, blockages, incipient taproots, or points of structuration' (1987: 13).

Yet, established and empirical methods of investigation can produce evidence and arguments of a different sort from those produced through mapping and can help to 'ground' what has been mapped. For example, Sam tried out some speculative fiction, which portrayed challenging social encounters between an Alexa EchoDot, its owner, and a guest of the household, and demonstrated a creative mapping of a territory of inquiry that went beyond what can be factually known. He also annotated this story to propose some established ways of testing out his mapped relations, such as investigations of the datasets and algorithms held by Amazon. These latter forms of inquiry are suggestive of tracing: representations of what is already there, in forms we can already understand.

An advantage of mapping is the decentring of technology. While we might start with questions about a technology, these are seen as always embedded in social and material relations. Maps, of the kind we have described above, have no centre (Deleuze and Guattari 1987) and can expand in any direction. A refusal to centre or be centred (e.g. to focus too much on technology) but, instead, to emphasise relations and embeddedness seems, to us, to be a potential ingredient of postdigital research.

During the course, students were, therefore, encouraged to think about how particular, situated uses of technology or technological practices were embedded (e.g. how they were implicated in political or economic agendas, or in specific cultural contexts, or in environmental or biological concerns). Postdigital tracings, then, must be put onto these 'maps' (Deleuze and Guattari 1987), such that they are understood as tentative, precarious, and ephemeral ways of tying mapped elements together. The utility of tracings is that they can help us to see some of the historical, actual, and

possible entanglements missed by mapping. For us, tracing involved ways of understanding how things are, or might be, entangled. In our employee monitoring software example, students discussed how they might use metrics, document analysis, and interviews to trace implications of a particular configuration of the software for relationships between workers and management, employee retention, worker behaviour and attitudes, customer service, productivity, or company finances.

Thus, mapping and tracing worked together in our course. Mapping helped us to identify more potential relations to trace, and tracing helped us to make more connections between mapped elements. Tracing could also help generate more points for mapping (e.g. looking at the times at which employees 'clocked in' could lead to speculation about building architecture, commuting, social activity between employees, etc.). Tracing need not be sequential (we could retrace our steps, or go back and take another path, or we could trace backwards from a variety of mapped elements), nor linear (we did not need to follow straight lines between mapped elements but could take detours along the way, and multiple threads could be traced between elements). Indeed, looking at multiple tracings together, rather than focusing only on individual threads, could help us to see a broader and more complex picture (see our discussion of Barad's 2007 lightning analogy, below). As we argue below, this negotiation of mapping and tracing may be a valuable aspect of postdigital exploration, beyond the kind involved in structured learning activities such as ours, including research.

Postdigital Inquiry and Research as Creative

Fawns and Schaepkens (2022) mapped ways in which candidates of an online proctored exam might have been oppressed by norms, scripts, and trust relations, produced by medical education institutions, educational technology companies, exam cultures, and marketisation. Their postdigital analysis of these issues involved tracing hypotheticals and then remapping them within the area of inquiry. While Deleuze and Guattari (1987) conceive of tracing as stuck in dominant ways of understanding, in our course, we saw this as part of many of our speculative and creative processes of mapping.

For us, postdigital inquiry is as much about creation as it is about discovery. It creates ideas, ways of thinking, new methods, conversations, conclusions, and connections (between groups of people; areas of thought; technologies, people, and wider systems and ecosystems). The word 'tracing' implies a going over of already existing lines of connection. It has connotations of representation (i.e. it shows what is) (Deleuze and Guattari 1987; Martin and Kamberelis 2013; Wang 2015), but this, we argue, is one of the ways in which mapping is grounded and shaped, by pulling and severing some connections, and creating others. Mapping is partly enabled by tracing, and the to-and-fro of mapping and tracing is the engine of the inquiry. For us, the distinction between tracing and mapping in postdigital inquiry is not whether it is generative or representational, but the manner in which it contributes to generation.

Postdigital relations are not simply there, waiting to be illuminated. They are intentionally (and, perhaps, unintentionally) created by researchers, who develop paths of inquiry that can help them locate technologies in complexity. This involves

mapping relevant territory and tracing entanglements within it that do not exist as physical entities (or objects) but as conceptions of invisible relations. To do this, researchers engage in a process of reification so that there is something that can be traced. Deleuze and Guattari (1987) are right that tracing rigidifies and reifies, and such reifications are distortions in need of remapping. Yet, as we have argued, tracing and mapping work in combination, and this combination provides ways of getting beyond previous understandings. Creative methods allow researchers to build useful and varied reifications that can be built upon to facilitate further mapping and tracing. Thus, it is possible to extricate ideas from tracings that might otherwise reinforce the dominance of tired old methods and 'put them to strange new uses' (Deleuze and Guattari 1987: 15).

In this context, it is appropriate for tracings to go beyond the actual. For us, postdigital inquiry must contain some analysis of 'digital' technology, but this could be connected to actual, historical, hypothetical, or possible activity. For example, one could conduct a postdigital analysis of a classroom in which devices and digital technology are banned, because such restrictions are a comment on the digital (or, at least, can be mapped as such). Furthermore, the existence of digital possibilities outside of the class would inevitably influence possibilities within it (e.g. where a student decides to look something up on the Internet later) (Fawns 2019).

Barad (2007) describes the way a lightning strike involves a feeling out of possible pathways before committing to one and tracing it down to earth. This kind of tracing is not copying or revealing what is already there but selectively building pathways from a wide range of extant possibilities. It is a progressive, generative reification that makes use of multiple dimensions. These reifications are not the same as the phenomenon being analysed; they are proxies. Tracings are also not, in themselves, an analysis. They are different connections that can form a holistic view (as when alternative pathways are illuminated by the glow of the lightning strike that contains, and is partly constituted by, after-images of unrealised potentials). Like our students in their explorations within our course, postdigital researchers trace potentials in the hope of a lightning strike of creative inspiration. In this analogy, we might say that they are tracing from speculative and creative points of mapping (ideas floating in the clouds) to empirically grounded points. Those involved in postdigital inquiry also need to be open to remapping and retracing once they have seen what is illuminated by previous mapping and tracing. Finality is the adversary of postdigital inquiry, and postdigital research is never finished. Publication and forms of dissemination, for example, are not signs of completion but punctuation along the way to something else. This is part of holding open definitions of what postdigital research is.

Ontologies: Locating a Postdigital Tradition While Encouraging Interdisciplinarity

Considering how postdigital is related to other traditions can help us to more clearly see what it means (and does not mean) to do postdigital research. Postdigital scholarship is frequently informed by ideas from philosophers of technology and media theorists. For example, the work of Feenberg (1999), Winner (1980), Postman

(1993), McLuhan (2001), and others has frequently been cited within journal articles positioned as postdigital. In an education context, postdigital works have drawn on more recent publications by Hamilton and Friesen (2013), Kanuka (2008), Oliver (2011), and adjacent fields such as Networked Learning (e.g. Networked Learning Editorial Collective et al. 2021; Networked Learning Editorial Collective 2021; Carvalho et al. 2016), digital education (e.g. Selwyn 2017), and critical digital pedagogy (e.g. Morris and Stommel 2018). Postdigital approaches also overlap with, or share properties, similarities, and historical roots with, other approaches to understanding complexity, such as posthumanism and sociomaterialism (Braidotti 2013, 2019; Fenwick 2015; Orlikowski 2007). In writing this paper, a discussion of sociomateriality, in particular, and its relationship with postdigital inquiry led us to a tentative position on ontology and interdisciplinarity, which we work through below.

Sociomaterial approaches take the whole system into account, focus on relations between human and non-human elements rather than on the separate elements, and understand knowledge, learning, and being, as embedded in these relations (Fenwick 2015). For example, a Cultural-Historical Activity Theory (CHAT) approach (Sannino and Engeström 2018) can be taken to locate digital activity in the context of histories of interactions. Spatial or topological theories (e.g. Mol and Law 1994) can help us to focus on spaces as constantly being enacted through digital, social, and material activity. Not all sociomaterial approaches are postdigital, particularly where they do not explicitly consider actual or potential digital activity. However, given our emphasis on holism, entanglements, and the inseparability of digital and other elements, we might ask whether a postdigital perspective is necessarily a sociomaterial perspective.

From a sociomaterial perspective, things do not exist independently, but are understood purely in terms of relations and holistic, co-emergence. Ontology and epistemology collapse into 'onto-epistemology' where understanding a thing and how we come to understand that thing are one and the same. There is no distinction between subject and object or between 'knowledge, knowers and known' (Fenwick 2010: 112). This is a powerful perspective for understanding and dealing with complexity, because it challenges taken-for-granted conceptions of technologies, humans, and their combinations. It opens up productive postdigital analytical possibilities for complex situations, as evidenced in the work of Gourlay (2022a), Tyrrell and Shalavin (2022), and Wagener-Böck et al. (2023). But is this the only ontology capable of seeing the postdigital and its refusal to separate digital, material, and social activity? Even within the authorship team of this paper, we have not reached consensus on whether postdigital is necessarily sociomaterial or not. On one hand, we are bound to understandings of complexity. On the other hand, we are committed to the promotion of interdisciplinarity and transdisciplinarity within the postdigital research community. For this reason, we propose holding open both views: that postdigital is necessarily sociomaterial, and also that it is not.

This brings us to a philosophical and interdisciplinary tension between different ways of understanding technology in relation to the social and material environments in which it is situated. Either technology is separate from, but in a tight relationship with, the world around it, or it is part of the same broader, complex entity. Do technology and people have reciprocal effects on each other, for example, or are they co-constitutive elements of a greater, dynamic assemblage of multiple kinds of things acting and existing together? If both perspectives are useful (which we think

they are), then we require a definition of postdigital that is able to account for at least two, and probably more, onto-epistemological positions.

We propose, then, that while individual research projects need ontological and epistemological clarity and coherence, the most valuable position to take in relation to postdigital scholarship as a whole (and the communities that produce and consume it) is one that is open to a plurality of philosophical positions. We do not want to argue that any epistemology will do for postdigital research. An understanding of the relationship between digital, social, and material as rooted in complexity entails rejecting notions of technological determinism, essentialism, and instrumentalism in favour of a messier view of socio-technical relations. However, Feenberg (2019), for example, arrives at postdigital complexity via philosophy. Peters and Besley (2019) reject determinism and instrumentalism, not via sociomateriality but by drawing on quantum theory and cybernetics.

To engage in collective action and meaning-making, researchers from different fields and disciplines need ways of negotiating a mutual understanding of what they are dealing with. If collaboration across disciplines and traditions is a crucial ingredient of postdigital research (Jandrić and Knox 2022), this means valuing diverse perspectives and approaches. For instance, postdigital work is useful in helping us guard against reductive metrics (Fawns et al. 2021; Gourlay 2022b), but postdigital inquiry could definitely include, and benefit from, quantitative data and analysis, as long as it forms part of an account that locates the digital within complexity.

Productive dialogue will, we think, benefit less from pitting different epistemological positions against each other, or from overly constrained ideas of what it means to do postdigital research, and more from the generation of new meanings from thoughtful and reflexive engagement with different kinds of work in the hope of transforming postdigital understandings and research practices (see Mazzei and McCoy 2010 for a related argument about the work of Deleuze and Guattari). An openness to diverse perspectives is not a reluctance to examine the philosophical positions that inform methods and methodologies, and a willingness to engage with these concepts will support postdigital research and its communities. Differing epistemological positions should be made explicit and held in productive tension. Lather (2006) introduces the concept of 'paradigm proliferation' to argue against reconciliation and against 'paradigm war', and instead to encourage 'thinking difference differently, a reappropriation of contradictory available scripts to create alternative practices of research as a site of being and becoming. In such a place, the task becomes to find a way to work on in the face of both the loss of legitimising metanarratives and, paradoxically, the imposition of a new orthodoxy' (Lather 2006: 52).

For us, then, the question becomes about 'negotiating' complex landscapes and not closing down possibilities that may help us to do so now and in the future. Beyond simply rejecting determinism and instrumentalism, an aim for postdigital research is also the 'development of alternative narratives' (Jandrić and Knox 2022) that can open up new lines of thinking. While this can be made richer by being inclusive and bringing in different kinds of people, Jandrić and Knox caution that interdisciplinary work can become tightly defined and constrained by particular disciplines (e.g. data science) and 'en vogue methods' that become 'dominant or overly

authoritative' (2022: 790). Jandrić and Knox propose *transdisciplinarity* (crudely, where different methodologies brought from disciplines are transformed in the mix) as more conducive to cross-fertilisation than interdisciplinarity (where methodologies often 'remain fixed within specific disciplinary customs' (789)).

What matters here is not the nature of any single data source but how an ethic of critical reflexivity is threaded through processes of data generation, analysis, synthesis, interpretation, sense-making, and application. For example, while some qualitative researchers have criticised quantitative research for often obscuring or reducing context and complexity, especially in relation to social activity, sociomaterialism has posed problems for a common focus of qualitative research on human experience as a guide to understanding the world, by challenging the idea of a stable, knowable, and autonomous human subject. In discussing a post-qualitative turn, Lather and St. Pierre (2013: 630) ask whether qualitative inquiry will be possible: 'if we see language, the human, and the material not as separate entities mixed together but as completely imbricated "on the surface"'. The notion that research transforms what is researched may manifest as a heightened tension in interdisciplinary work where some parties are less familiar with challenging ideas of objectivity or neutrality.

In transdisciplinary research, new methodologies are created in which problems are put together collaboratively through new ways of seeing and constructing. For Lury (2021), St. Pierre (2021), Barad (2007), and other philosophers of the sociomaterial, realities are made by and through methods and methodologies. St. Pierre (2021), for example, argues for forms of post-qualitative inquiry that must be invented differently for each problem or study. Lury describes this in terms of 'putting a problem together' that is 'not acted on in a space but emerges across a problem space, from with-in and out-with' (2021: 3). As we saw in the learning and teaching context of our course, speculative design, for example, can be helpful for 'putting problems together' because of its potential to open up new perspectives on complex problems and alternative ways of being (Dunne and Raby 2013).

Thus, while holding postdigital inquiry open to a range of perspectives and disciplines is desirable, we also argue that these perspectives and disciplines should not remain untouched by their participation. Emergent new methodologies and ways of seeing should be produced through the research, and these should contain certain essential and desirable postdigital 'ingredients' that we outline below.

Ingredients for Postdigital Research

A potential criticism of postdigital research is that its conception and boundaries are too vague. Postdigital conceptions can be difficult to challenge where they are not tightly pinned down. In addition, too much stretching of the postdigital will cause the concept to lose integrity or become weak. For example, it is easy to expand what is covered by postdigital research by adding in new angles as they arise, such as by arguing that it also takes biology, or philosophy, or religion into account. However, we might also ask whether we need a unified conception of 'postdigital' to do postdigital research.

Postdigital research, for us, requires a perspective or sensibility that can be said to be postdigital, but it need not be labelled as such, and there may be more than one possible postdigital perspective. At the same time, it would be useful to have a way of differentiating those positions that are postdigital from those that are not. Thus, we propose an 'essential' ingredient, without which we would not call the research 'postdigital' (though we might defend the right of others to do so!), and some 'desirable' ingredients that we think indicate and strengthen postdigital research.

An Essential Ingredient for Postdigital Research: an On-yet-around Focus

Postdigital inquiry helps researchers to see technologies and practices as entangled parts of more complex wholes. As Morin (2014) suggests, when considering complexity, we need ways of distinguishing elements without disconnecting them or hiding their uncertainties, ambiguities, and contradictions. For this, researchers do not need a fixed focus on a specific technology or practice but a moveable gaze of inquiry, which must start somewhere, but then move around as they trace relations, and zoom in and out, from fine-grained features and micro-level activity, to broader assemblages and contexts. This movement involves navigating a tension between focusing *on* a technology to appreciate its uses and effects and focusing on relations within and across wider systems or eco-systems or assemblages, of which technologies are only a part. Thus, postdigital inquiry entails a dual focus, simultaneously *on-yet-around* 'digital' technology and practices.

As an analogy, we can attend to the wonder of our planet (*on*), while simultaneously being aware of its cosmic insignificance—as just a small, integrated part of a far greater tapestry, moving in equilibrium with vast numbers of other elements (*around*). Similarly, we can attend to the diversity of functions and forms of particular technologies, individually or in combination, while also considering them as non-dominant, inseparable elements of wider tapestries of distributed activity. Or we might focus primarily on one aspect of society—economic, biological, political, environmental, cultural, etc.—but not in isolation of the rest.

For us, a criterion of postdigital analysis is that it is accompanied by a refusal to remain in an isolating gaze. Ultimately, the focus of the gaze must move to connections, relations, and interstitial spaces. Taking an *on-yet-around* approach means we do not exclusively focus on technologies, while also holding those technologies and their embeddedness within view. Note that this is different from on-*and*-around, in that we do not simply focus on technology and its setting but on the tensions between the two. The 'yet' signals that this is not simply a smooth and comfortable plurality but that these multiple understandings are in productive dissonance, each refusing the other rest and stability.

Desirable Ingredients

Including Diverse Voices and Perspectives

Postdigital inquiry involves a relentless effort to question or refuse boundaries: between technologies, people, environments, disciplines, epistemologies, and methodologies. It stretches and generates ideas through expansion and exploration. Bringing in

researchers from various disciplines, geographical locations, cultures, etc. can help us see the world differently. One of the benefits of our Postdigital Society course was that, by inviting students from different disciplines, it encouraged all of us (including teachers and researchers) to be open to new ideas about what postdigital inquiry could be. Following Jandrić and Ford (2022), we suggest leaving the question of what counts as postdigital open for as long as possible, so that it is possible for members of a range of disciplines and backgrounds to participate. That definitions are not yet settled has valuable productive possibilities for research and dialogue.

Fostering Transdisciplinarity

In our course, working across disciplines opened up new lines of conversation and a greater repertoire of possible methods. Similarly, in a research context, we suggest that postdigital thinking can be strengthened through different views of the empirical as well as through consideration of the hypothetical (such as in the examples, above, of speculative fiction or the ideation of methods about design fictions). In our course, however, there were also moments of frustration and inertia and sites of tension and struggle. For example, students could become creatively paralysed or to revert to looking for quantifiable hypotheses or causal explanations that were difficult to reconcile with a postdigital view of non-linear and complex relations between elements. Similar challenges may arise where researchers with different epistemologies try to negotiate methods and interpretations with a view to examining postdigital complexity.

On the other hand, current postdigital research is often weighted towards critique of technology. While this can be seen as part of broader critical movements (e.g. in relation to educational technology research) (see Macgilchrist 2021), it can also be a blind spot around the need to engage productively or effectively with digital technology. Mixing disciplines can help us to look for risks, potential harms, and ethical complexity and also positive ways to engage with technology such that the emergent activity aligns with the values and purposes of different stakeholders (Fawns 2022). Such negotiation of views, disciplines, and contexts has great potential for people to learn from others and, individually and collectively, to expand their horizons (Aitken 2021).

Working Creatively, Speculatively, and Compositionally

In principle, any methods could be used within a broader postdigital approach, but a holistic view across methods is suggestive, to us, of working speculatively and compositionally. Being open to transdisciplinary work calls for new ways of thinking and doing research. Where Hurley and Al-Ali (2021) propose a turn to post-qualitative approaches as part of a 'refusal of prescriptive methods', we would extend this to an openness to 'put the problem together' in creative and inclusive ways by drawing on a range of possible methods. Yet, we cannot simply enact a series of disjointed methods and call it postdigital research, and there are tensions and opportunities that emerge in the combination of approaches.

Creative and compositional approaches can be framed and discussed within a post-qualitative framework. As we discussed in relation to other 'posts', above, this

does not signal a complete rupture with qualitative methodologies (nor the outright rejection of quantitative ones). Instead, working post-qualitatively means taking up methods and methodologies—and creating new ones—in ways that are sensitive to the realities they produce.

This sensitivity has been described in a number of ways, including as what Lury and Wakeford (2012) call 'inventive methods', but Lury's (2021) recent work on compositional methodologies and problem spaces is particularly apt for postdigital research. Here, we might learn from our students' mixing of disciplinary design approaches (e.g. storyboarding and journey mapping) with more speculative design methods aimed at exploring and creating 'possible futures under conditions of complexity and uncertainty' (Ross 2018: 197). Rather than trying to create aspirational futures, the aim was to create a diverse range of possibilities to help us think about how things might become (Facer 2016).

Speculative methods are not only about the future, but are rooted in the present, shedding light on both the issues that are of current concern, but also what is left aside or silenced (Law 2004: 113). They can offer a new perspective on what matters now, 'what issues and problems we have inherited and what debates define what can and cannot currently be thought about or imagined' (Ross 2017: 220). Finally, speculative design is open to different disciplinary approaches, each participant contributing to the process from the perspective of their own field. Thus, speculative approaches can be used to ensure that a diversity of points of view, disciplines, and cultures are included and to offer a rich and deep palette of possibles (Gough 2010).

Compositional methodologies can generate ambiguous problems in which questions and answers are blurred (Ross 2023). Indeed, even in the educational context of our course, many of our attempts to develop approaches to postdigital inquiry were helpful in generating a more complex sense of problems and questions such that they became unanswerable. For example, through a process of creative visualisation and discussion, the question of how an online Miro whiteboard shapes the dialogue that happens in a hybrid class quickly became entangled in institutional policy, infrastructure, time zones, pedagogical approach, and the personal circumstances of individual students. Importantly, in research, this does not mean that 'anything goes' because the legitimacy of an inventive method 'is tied to its ability to engage with and affect the problem it addresses' (Ross 2023: 62).

What Makes Good Postdigital Research?

The word postdigital is useful to connect together members of a research community and to remind researchers to look beyond the digital. But 'postdigital' is just a word, to be used while it is useful (Cramer and Jandrić 2021). We think that it will remain so until looking simultaneously at, and beyond, technology, and digital activity, is embedded in mainstream research. There are not yet clear rules for postdigital research, but whether or not a project can or should be labelled as postdigital is less important than whether it contributes to our understanding of technology as embedded in complexity. Part of the purpose of postdigital inquiry is to help us 'keep looking for ways to broaden our view' (Ross and Collier 2016: 28). Good

postdigital research, then, is less about any particular output and more about the productive punctuation of a broader, ongoing conversation that opens up further inquiry through generating new questions rather than closing it down with answers.

Conclusions

In this paper, we have reflected on our experiences, as teachers and students, of a pilot course called Postdigital Society at the Edinburgh Futures Institute (part of the University of Edinburgh) and used these reflections to consider what it means to do postdigital research. In the course, students from different disciplines worked together to develop a range of proposed methods for postdigital analyses of technology-related topics (e.g. an Alexa EchoDot, employee monitoring software, an online Miro whiteboard). Applying our experiences to a research context has raised questions about how we define objects of postdigital analysis and what epistemological constraints are involved in taking up a postdigital perspective.

We have argued that it is valuable to think about epistemology and ways of conceptualising complexity in postdigital research and about reconciling these with different kinds of, potentially, creative and speculative methods. Given the value of transdisciplinary work, we have argued for holding open postdigital definitions and epistemologies, without losing critical and embedded views of technology. For us, postdigital is not an epistemology, or a particular approach to research, but a way of focusing that situates technology or practices in complexity. For this, we offer some essential and desirable ingredients for postdigital research.

Essentially, postdigital inquiry should focus on-yet-around technology, meaning that it notices the characteristics of the technology but also looks beyond them to the relations between those characteristics and the wider context in which they are embedded. We also propose some desirable or aspirational characteristics (research can still be characterised as postdigital without these, but they support the generation of valuable opportunities for developing the field).

Firstly, we see it as beneficial to welcome diverse perspectives and disciplines in ways that support the generation of critical views and innovative methods. Secondly, this can be helped by fostering transdisciplinarity, in the sense that different disciplinary perspectives and traditions cross-fertilise to produce something beyond the narrow view of any one discipline. Thirdly, postdigital inquiry benefits from working creatively, speculatively, and compositionally, where methods and methodologies are generated to encourage imagination and discussion of a range of alternative possible futures.

All of these ingredients can promote further critical dialogue and inquiry about the role of digital technology as embedded in society. That, for us, is what characterises 'good' postdigital research.

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