Doing new materialist data analysis: a Spinozo-Deleuzian ethological toolkit

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Abstract

With growing social science interest in new materialist and posthuman ontologies, it is timely to explore how these may translate practically into social research methodologies. This task is complicated by differing interpretations of how new materialist precepts should shape research. This paper aims to fill a gap in the literature by setting out a methodology using one specific thread within the new materialisms: Deleuzian 'ethology'. Inspired by Spinoza's *Ethics*, Deleuze established a conceptual toolkit for ethological inquiry, comprising 'relation', 'assemblage', 'affect' and 'capacity'. We show how this toolkit translates into a design for analysing empirical data. Effective data analysis also depends on the adequacy and appropriateness of earlier stages in the research process. We therefore also consider an ethological approach to setting a research question, choosing data collection methods and presenting study findings. We conclude with some reflections on the challenges of translating philosophical theory into social science methodology.

Keywords: assemblage, data analysis, Deleuze, ethology, new materialism, research assemblage

Introduction: new materialism and social research

Across the social sciences, new materialist perspectives are informing research (Fox and Alldred, 2017; Coole and Frost, 2010). This 'turn to matter' in empirical research has been hampered, however, by a lack of exploration of how ontology translates into methodology and thence to specific research methods. Those wishing to undertake empirical studies have sometimes struggled to find ways to convert the scholarly insights of a wide range of authors who have been aggregated under the portfolio label of 'new materialist', 'posthumanist' or 'vital materialist' (for example, Barad, 2007; Bennett, 2010; Braidotti, 2006, 2013; DeLanda, 2006, 2026; Deleuze and Guattari, 1984, 1988; Latour, 2005; Massumi, 1996, 2015; Thrift, 2008) into a viable social science methodology.

Given the divergences between these authors' framings of the new materialisms, it is unsurprising that the suggested practices associated with doing 'new materialist research' are disparate and often contradictory. For instance, post-qualitative researchers have rejected interviews as irrevocably humanist (Lather and St Pierre, 2013; St Pierre, 2014), while those interested in affect have retained this data collection tool as a useful source of data (Fox and Alldred, 2017; Potts, 2004; Warfield, 2017). Advocates of Karen Barad's perspective have espoused a 'diffractive' approach to data analysis that considers researchers' own biographies and subjective insights as valuable sources for interpreting data (Davies, 2014; Lenz Taguchi and Palmer, 2013). DeLanda, by contrast, finds in the work of Deleuze the foundations for a realist analysis of the social world (2006, 2016). Open-ness to the affectivity of the non-human can sensitise researchers to assemblages, suggests McLeod (2014: 384). St Pierre's promotion of 'post-qualitative inquiry' is predicated upon a wholesale rejection of methodology, arguing that a researcher's methods should emerge from their own readings in materialist and post-structuralist theory (St Pierre, 2020: 9; 2021: 6-7).

With this divergence of opinion, it is not feasible to set out a unified 'new materialist method' for analysing social data. Rather, we shall select one strand within the new materialisms, and use its core premises and concepts to develop an approach to data analysis. The chosen perspective is the 'ethology' of Gilles Deleuze, established in his book on Spinoza (Deleuze, 1988: 125-128) and operationalised in his work with Félix Guattari (Deleuze and Guattari, 1988: 150-152). Ethology's conceptual toolkit supplies a model of the social world that can straightforwardly inform a social scientific methodology of inquiry (Fox and Alldred, 2015). Our aim here is to undertake the necessary foundational work of establishing an ethological methodology, in order to provide both entry-level and experienced new materialist researchers with a basis from which to apply data analytic strategies to their empirical studies.

We begin by outlining the common themes within the new materialisms. Then we review Spinozo-Deleuzian ontology, and identify the core concepts applied by Deleuze and Guattari to establish their materialist and ethological understanding of the world natural and social. After that, we set about the task of applying this conceptual framing to the social enterprise of

research. This provides a basis upon which to develop an approach to data analysis, while also addressing other aspects of the research process – from setting a research question to writing up, that affect the data to be analysed and reported. We illustrate this data analysis methodology with an example from recent empirical research on health and non-human matter, and conclude by discussing the challenge of translating philosophy to social science research purposes.

Core themes in the new materialisms

Despite the breadth of approaches aggregated within the portfolio term 'new materialist', all may be characterized as posthumanist and post-anthropocentric (Braidotti, 2013: 86), materially embedded and embodied (Braidotti, 2011: 128), relational and contingent rather than essentialist or absolute (Coole and Frost, 2010: 29), and as supplying social theory with the means to re-immerse itself in a material world that is plural, complex, heterogeneous and emergent. New materialists consider that the world and history are produced by material forces that extend from the physical and the biological to the psychological, social and cultural (Barad, 1996: 181; Braidotti, 2013: 3). Materiality elides boundaries between natural and social worlds; and for some new materialist scholars is invested with a vitality or liveliness, as opposed to being inert and passive matter (Bennett, 2010).

By rejecting a distinction between the physical world and the social constructs of human thoughts, meanings and desires, new materialism opens up the possibility to explore how each affects the other, and how things other than humans (for instance, a tool, a technology or a building) can be social 'agents', making things happen. Its post-anthropocentrism displaces humans from the central focus of social inquiry, not only emancipating the affective capacities of the non-human but also establishing an ethics that can engage productively with human culture, with other living things, and with the wider environment of inanimate matter (Braidotti, 2013: 60).

This distinctive ontology has been described as 'flat' or 'monist' (rather than 'dualist'), rejecting differences between 'natural' and 'cultural' realms, human and non-human, structure/agency, reason/emotion, animate/inanimate and – perhaps most significantly – between mind and matter (van der Tuin and Dolphijn, 2010). Paradoxically, however, this

monist ontology is not a move to universalism or a unitary perspective upon the social or upon subjectivity, but rather opens up a multiplicity and diversity that exceeds and overwhelms the dichotomies they replace (Braidotti, 2011: 211; Deleuze and Guattari, 1988: 32). A monist ontology also marks a re-focusing of attention away from hierarchies, systems or structures beyond or beneath the surface of everyday activities and interactions. Exploring the relational character of the events that comprise the production and reproduction of the social world becomes the means for social science to explain the continuities, fluxes and 'becomings' that produce the world around us, rather than via structural or systemic 'explanations' of how societies and cultures work (Latour, 2005: 130). This has implications for research, requiring a focus upon the specific interactions between human and non-human matter that occur within events.

According to their advocates, the new materialisms afford a variety of theoretical and methodological opportunities deriving from their relational ontology. First, they reject the boundary dispute between 'social' and 'natural' sciences, questioning the very separation between nature and culture (Braidotti, 2013; Latour, 2005: 13). Second, new materialists regard the material world and its contents not as fixed, stable entities, but as relational and uneven, emerging in unpredictable ways around actions and events (Potts, 2004: 19). Third, the relationality of the world is in part operationalized via an understanding of agency that no longer privileges human action. Rather, a 'capacity to affect and be affected' (Deleuze and Guattari, 1988: 127-128) is a feature of all matter: human and non-human, animate and inanimate. This establishes a perspective upon the world as continuously *emergent* via a series of interactive and productive events/assemblages, rather than founded upon stable structures or systems. Finally, feminists, post-colonial scholars and queer theorists who have developed or adopted new materialist perspectives on social and political engagements find in them a framework that is materially embedded and embodied (Braidotti, 2011: 128) and can be used both to research the social world and to seek to change it for the better.

However, the shift in the new materialisms from essentialism to relationality poses challenges for any effort at social inquiry that seeks to report or represent the attributes of a research topic and the human bodies that it comprises (for instance, economic migration, sexual violence or vaccine hesitancy). New materialist scholars have questioned any effort by social

researchers to 'represent' the social world, and – generally speaking – are consequently 'post-representational' in outlook (St Pierre, 2014; Thrift, 2008). This issue was explicitly addressed by Deleuze and Guattari (1988: 374) in their critique of mainstream 'major' or 'Royal' science, which has the object of creating universal 'laws' (DeLanda, 2016: 91) based on a model of science as simply representing or reproducing the world it researches. Deleuze and Guattari's (1988: 367) recognition and promotion of a 'minor science' that runs alongside major science is based upon an alternative model of inquiry to representation, which they describe as 'following'. Their metaphor: rather than documenting the flow of a river flow from a fixed point on the bank, take to a boat and become part of the flow (Deleuze and Guattari, 1988: 372).[1] While some new materialist scholars regard any effort to shift social science toward a major key as foundationally misguided (see, for example, Barad, 2003: 815; St Pierre, 2019), it is worth noting that Deleuze and Guattari explicitly stated (ibid: 372) that following is '(n)ot better, just different' from reproduction.

Towards a new materialist methodology: Spinoza, Deleuze and ethology

In the face of new materialist diversity, we now explore one strand: Deleuze's Spinozist ontology of affects and assemblages that he called 'ethology' (Buchanan, 2000: 5; Deleuze, 1988: 125). We show how this conceptual 'toolkit' supplies a framework for a social research methodology and, in particular, a model for data analysis. In the following, key ethological concepts have been italicised.

Deleuze (1988) establishes ethology in his exegesis of Spinoza's monist philosophy. In this monist or 'immanent' ontology (Connolly, 2010: 178; Deleuze and Guattari, 1988: 266), bodies, objects, thoughts, social formations and other materialities are not to be defined by form, substance, subjectivity or fixed attributes, but simply by their capacities to affect or be affected – their *affects* (1988: 124). These *capacities* are not inherent, but emerge relationally when one body or thing assembles with other bodies or things or abstractions – which Deleuze calls *relations* (1988: 126). His application of this ontology, most notably in his work with Guattari (Deleuze and Guattari, 1984; 1988) supplies a model of action of relevance to social inquiry.

First, it treats human bodies and all other material, social and abstract entities as relational, having no ontological status or integrity other than that produced through their relationship to other similarly contingent and ephemeral bodies, things and ideas (Deleuze, 1988: 123; Deleuze and Guattari, 1988: 261). In DeleuzoGuattarian scholarship, these arrangements (Buchanan, 2017: 465) of bodies and things are described as machines (Deleuze and Guattari, 1984: 5) and then 'agencements' – commonly translated as *assemblages* (Deleuze and Guattari, 1988: 22). Assemblages develop in unpredictable ways around actions and events (Bennett, 2005: 445; Deleuze and Guattari 1988: 88), 'in a kind of chaotic network of habitual and non-habitual connections, always in flux, always reassembling in different ways' (Potts, 2004: 19): drawn together by their capacities to affect or be affected (Deleuze, 1988: 124). It is this affective flow, and this alone, that determines what a body or other thing can do (its *capacities*) within a particular context.

Second, this Spinozist conception of *affect* as a capacity to affect or be affected (Deleuze, 1988: 101) means that non-human matter as well as humans can be agentic. An affect is a 'becoming' (Deleuze and Guattari, 1988: 256) that represents a change of state of an entity and its capacities (Massumi, 1988: xvi): this change may be physical, psychological, emotional or social. Affects produce further affects within assemblages: because one affect can produce more than one capacity, affects flow 'rhizomically' (Deleuze and Guattari 1988: 7), branching, reversing flows, coalescing and rupturing, supplying a diachronic and dynamic understanding of production as an open-ended becoming (Goodley, 2007: 147), without beginning or end (Cluley, 2020: 288). The flow of affect within assemblages is the means by which lives, societies and history unfold, by 'adding capacities through interaction, in a world which is constantly becoming' (Thrift 2004: 61).

All social production, social formations, power relations and resistances emerge from these affective flows, which bring together micro and macro, personal and geopolitical (Deleuze, 1990: 207; Gatens 1996: 169). Flows of affect change the capacities of an entity (a body, a collectivity or a thing) in one direction or another (Duff 2010: 625), and may combine or cancel each other out. Two further DeleuzoGuattarian dichotomies explicate further how the *micropolitics* of affects within an assemblage may change a body's capacities (Deleuze and Guattari, 1988: 216). *Territorialisation* and *de-territorialisation* describe how affects

produce the capacities of a body or other entity. This nomenclature suggests that – in an assemblage – a body, an object, or other relation is a 'territory', established and fought over by rival affects (Deleuze and Guattari, 1988: 88-89). Territorialisation may be understood as a process of *specification* (Fox and Alldred, 2017: 32) in the sense that (in French) *terroir* acknowledges how features in the immediate physical environment of a vine or beehive specify qualities in the wine or honey they produce. Thus affects within a particular assemblage specify the capacities of a body or other relation. For example, a tooling affect may specify a piece of metal as a screwdriver with specific capacities to tighten or loosen screws. De-territorialisation marks out the opposing tendency of an affect: to open up new possibilities for a body when it assembles with certain other relations. It is thus a *generalisation* of capacities (ibid: 18). For instance, a screwdriver can be re-purposed in other assemblages as chisel, lever or even weapon. These two antagonistic movements of specification and generalisation mean that the possibilities and limits upon what a body can do (capacities) also fluctuate continuously and unendingly (Thrift, 2004: 61).

Deleuze and Guattari's dualism of *molar* and *molecular* flows of affect in assemblages describe a second micropolitical aspect of how affects may influence what a body can do. 'Molar' affects *aggregate*, and act similarly on multiple bodies, organizing or categorizing them to create converging identities or capacities. They draw bodies and things into collectivities, and smooth out differences and divergences to artificially squeeze disparate bodies into categories such as classes or races (Clough, 2008: 2, DeLanda, 2006: 72, Deleuze and Guattari, 1984: 286-288). Aggregative forces are frequent features of social life, and include systems of thought or discourses, orthodoxies, evaluative categorisations, codifications, cultural norms and so forth (Fox and Alldred, 2013: 776; Potts, 2004: 20). These can affect a relation's capacities radically, closing down possibilities for action or interaction. By contrast, 'molecular' affects are not aggregative, but instead produce a *singular* outcome or capacity in just one body or other relation, with no significance beyond itself, and without aggregating consequences. For instance, naming a new pet kitten Daisy is a singular affect, while categorising it as tabby or tortoiseshell is aggregative. Singular affects can enable bodies to resist both aggregating and constraining (territorialising/specifying) forces, opening up new capacities to act, feel or desire.

Ethology is the study of 'capacities for affecting and being affected', and of how these capacities diminish or strengthen a body's or a thing's power to act (Deleuze, 1988: 125-126). Along with the differentiations between specification/generalisation and aggregative/singular affects established in his later work with Guattari, ethology's conceptual toolkit offers social science an ontology that directly translates into a methodology to study a relational and more-than-human world, as illustrated in Deleuze and Guattari's (1988: 149-156, 257) various explorations in *A Thousand Plateaus*. It also supplies a new materialist understanding of research and research methodology itself, inasmuch as the research process *needs itself to be understood as an assemblage* of human and non-human relations.

Within this research-assemblage of research topic, methods and researchers (Fox and Alldred, 2015b, 2018; Coleman and Ringrose, 2013: 17; Shildrick et al, 2018), a flow of affect produces both intended consequences (doing 'research') and unintended consequences – the disparate effects of research processes and researcher commitments upon findings and sometimes events they study. Each and every research act assembles from specific research tools (such as questionnaires, interview schedules or scientific apparatus); recording and analysis technologies, computer software and hardware; theoretical frameworks and hypotheses; research literatures and findings from earlier studies; the 'data' generated by these methods and techniques; the 'events' to be researched; the physical spaces and establishments where research takes place; the frameworks and cultures of scientific research; ethical principles and committees; libraries, journals, books and editors; and of course, the human researchers themselves (Fox and Alldred, 2015b: 404; Mannion, 2020; Warfield, 2017).

This complex assemblage can be decomposed into a series of simpler *research machines* that undertake specific tasks within a research process – such as data collection, data analysis or ethical review. Each machine has a specific affective flow that makes it work (Fox and Alldred, 2015a; Warfield, 2017: 67). Thus, a data collection machine takes aspects of an event as its raw material, and – by the means specific to its design – generates 'data'. An analysis machine processes data according to rules specific to an approach (for instance, thematic analysis or discourse analysis) to produce 'findings' in the form of generalities or summaries, and so forth. Research techniques such as sampling, ethical approval, data

validation and writing-up can all be treated as machines within a research-assemblage, each enabling particular research capacities within a methodology.

Scrutiny of the common techniques, methods and designs used in social research has indicated (Fox and Alldred, 2015b) that almost all have specifying and/or aggregating effects on the data they collect or analyse: tending to produce simplicity where there was complexity, definition in place of indeterminacy, and evenness rather than variability. For instance, affects in a thematic qualitative analysis machine will summarise data by artificially reducing its complexity and aggregating disparate events together into themes; statistical analysis is similarly an effort to reduce complex data to a few numbers. Occasionally, the affects in a research design may alter the very events that they purport merely to observe: 'Hawthorne effects' in which observation of workers increases their productivity have been found in a range of settings (McCambridge et al, 2014).

This ethological analysis of the research-assemblage confirms that research can in no way be considered a transparent process that simply 'reproduces' events in its findings. However, it also reveals that the affects in different research machines have differing micropolitical effects on 'data', and hence on how the social world is shaped into 'findings' and 'knowledge' during the research process. Because research machines have varying micropolitical effects, by manipulating the mix of machines in a research design, it is possible to also vary the impact of research on social knowledge.[2] As we turn to developing an ethological research design – which falls squarely within the minor science strategy of 'following' phenomena (Duff, 2014: 6) – this potential to pro-actively engineer research micropolitics may be borne in mind.

A Spinozo-Deleuzian ethological approach to data analysis

The earlier sections suggest that any effort to establish a 'new materialist' methodology should:

- be open to a post-anthropocentric, posthuman and more-than-human sensibility;
- focus on assemblages, affects and emergent capacities rather than individual bodies and their supposedly essential attributes;

- attend to the complex flows of affect in the everyday events that progressively and endlessly produce and reproduce the social world and human lives; and
- acknowledge research as itself an affective assemblage comprising both human and non-human components.

The application of an ethological framework for new materialist research entails applying the conceptual framework set out in the earlier section on Spinozo-Deleuzian ontology. However, in order for data to be analysed according to an ethological framework, it is crucial that *appropriate* data is available. Consequently, a strategy to apply ethology to data analysis must address not only methods of analysis, but also earlier and later stages in the research process. Consequently, in what follows we consider these other stages from within the Spinozo-Deleuzian ethological approach. We address the selection of an appropriate research question, and then how to operationalise this question in terms of data collection tools and methods. We then consider how data may be analysed, and finally techniques for presenting this analysis using an ethological orientation.

Setting a research question

An ethological ontology of relations and assemblages, affective flows and capacities differ substantively from those to be found in a conventional anthropocentric and humanist focus on thoughts, beliefs, attitudes, experiences, hopes and fears or expectations (and how these articulate with the social). An ethological approach consequently requires a more-than-human sensibility when it comes to setting a research question.

To explore this further, consider a fictitious research project on the negative effects upon ageing residents of social change in a neighbourhood. In many regions of the UK and other industrialised countries, neighbourhoods have experienced significant changes over the past 40 years due to loss of traditional industries such as coal-mining, steel-making and ceramics; closure of amenities such as shops, post-offices and community leisure facilities, degradation of housing stock, increasing social inequalities, vandalism, and changes to the demographic profile of local residents. An anthropocentric research question addressing this social change might be:

What are the attitudes and views of elderly people to social changes in their neighbourhood?

This question establishes a narrow, humanistic focus on human responses to environment change. It is reflective of the kind of humanist and anthropocentric research that emerged in both interactionist and social constructionist perspectives in the last century, and continues to be reported in contemporary research studies.[3] The kind of data that would be collected by such a research question would not sit comfortably with the more-than-human, relational ontology set out earlier in this paper. While it may gather data on human beliefs and constructs concerning a changing social environment, it would likely fail to collect broader data relevant to a new materialist focus on the sociomaterial production of the social world. Furthermore, it offers privileged status to human agency and respondents' social constructions of their neighbourhood, and consequently fails to fully explicate the material, affective and more-than-human forces driving social changes. If instead, a researcher wishes to use a materialist and more-than-human approach to the topic, a research question more suited to gather data on relations, affective flows and capacities is needed. Such a question might be worded as follows:

How have changes in neighbourhood X since 2000 affected residents over 60?

This question both enables exploration of the breadth of sociomaterial affects in neighbourhood X, while not denying the impacts, including psychosocial affects, such changes may have had on humans. In addition, it opens up the potential to gather data from a wide range of primary, secondary and documentary sources, using a range of differing qualitative and quantitative data collection methods, rather than individualistic and anthropocentric methods such as surveys and interviews (see next sub-section).

More generally: an adequate and appropriate research question for a (Spinozo-Deleuzian-inspired) new materialist research study needs to enable data to be collected that can provide insight into the affects in the more-than-human assemblage that comprises a phenomenon,

and the capacities that this assemblage produces in its component human and/or non-human relations.

Data collection

The principal criterion for selection of an appropriate data collection method or methods is its ability to provide data relevant to the objects of analysis set out in the previous sub-section, namely: relations and assemblages, affective flows and capacities. As a consequence, any method or combination of methods are potentially of use, so long as they are designed specifically to gather data on these objects of analysis, and are open to a more-than-human (as opposed to humanistic) sensibility. Possible data gathering methods are summarised in Box A.

Box A

Qualitative data from focused individual or group interviews can be highly productive sources of data on the relations and affects in a setting, and the capacities that these produce in human bodies. An example of an interview schedule seeking to elicit data on interactions with non-human matter at work and in the home is provided as Appendix 1.

Respondent-led methods such as 'walking tours', in which a respondent conducts a tour of a setting to point out its salient affective features.

Arts-based methods involving individual or group creative activities may be a means to elicit and/or explore affects and emergent capacities related to a research question.

Ethnographic observation may be valuable to identify relations and physical affects, but needs to be combined with some sort of 'insider' perspective, to supply data on other affects and the capacities these produce.

Survey and other sources of data on participants in a setting can be used to assess the prevalence of relations, affects or capacities, or alternatively, to provide a means to stratify the sample to compare/contrast some contextual aspect.

Documentary evidence may also be trawled for data on relations, affects and capacities. This includes qualitative or quantitative meta-analysis of published or unpublished materials on a topic.

While quantitative methods such as large-scale surveys may be valuable to gain insights into prevalence of relations, affects or capacities within a specific population or sub-population, qualitative approaches can provide more nuanced data on affects and capacities. As noted earlier, 'post-qualitative researchers' have rejected interviews as irredeemably humanist (Lather and St Pierre, 2013; St Pierre, 2014). Our view is that interviews can still serve as sources of data in a more-than-human study, if interviewees are considered not as privileged actors within a socially constructed setting, but rather in the way that 'key informants' are used in ethnographic studies: as insider sources of knowledge about a setting. Consequently, an interview schedule needs to reflect this shift in emphasis. Developments such as walking tours extend this approach to using respondents as key informants.[4]

Mixed methods studies can reap the benefits of both approaches. To continue with the example used earlier of a study of the effects of social change on older adults, a survey could gather background data on the kinds of changes occurring in a neighbourhood over a specific period, and the kinds of effects these changes had. Interviews, walking tours and observation might then provide more specific data on these affects and on the capacities these changes produced.

Data analysis methods

The ethological conceptual toolkit underpinning Spinozo-Deleuzian ontology suggest that the objectives of an appropriate 'data analysis research machine' are:

a) to identify human and non-human *relations* that assemble around particular events;

b) to disclose the *affects* (capacities to affect or be affected) that draw these relations into assemblage. These affects might be physical, psychological, social, economic, etc.;

c) to identify the *capacities* produced in bodies and other matter by these affects – what they can do;

d) to assess if there are *micropolitical* consequences for bodies or other non-human elements in the assemblage in terms of how capacities are either constrained (specified) or enabled (generalised), or if bodies are aggregated by particular affective flows in the assemblage.

Ethology's core concepts (relations, affects, capacities, micropolitics) not only provide a basis for analysis, and may be used to create a coding framework for analysis. For qualitative data, these can provide a framework for CAQDAS analysis using software such as NVivo. A basic coding frame for qualitative data is outlined in Box B: this might be amended or elaborated to suit the topic being studied, either at the outset or during coding.

Box B Coding frame for analysis

Relations

Human (e.g. friend, family, work colleague, shop-owner, manager).

Non-human (e.g. pet, tool, technology, vehicle, consumer goods, postbox).

Places and spaces (e.g. house, room, office, countryside, hospital, road).

Other (e.g. concepts such as marriage, 'the economy'; memories; desires).

Affects

Affects by or upon human relation.

Affects by or upon non-human relation.

Affects by or upon place or space

Physical affect

Psychological affect

Socio-cultural affect

Economic affect

Capacities

Enhanced capacity

Reduced/constrained capacity

Singular capacity

Aggregated capacity

This coding frame may be used to extract the data needed to report the findings, as considered next.

Writing up

The coding frame outlined in Box B provides an immediate structure for writing up the analysis. The authors have used a variety of different methods of reporting such an analysis, according to the specific research question being asked and the methods of data collection used.

- Summarise the range of humans and non-human relations, then provide examples of types of affects (e.g. physical, psychological, social), and then the enabling and constraining capacities produced by these affects.
- Document the assemblage of relations in an event textually or graphically, followed by examples of the affects and capacities produced.
- Summarise range of humans and non-human relations, then provide case studies to illustrate affective interactions with relations and the capacities produced.
- Use quantitative data to stratify a sample, and then summarise the qualitative data for members of the sub-samples: comparing and contrasting assemblages, affects and capacities.

In this section we have offered some guidelines on how an ethological data analysis may be conducted. The following section provides an illustration of a study using an ethological methodology.

Illustration: using new materialist data analysis

A recent study by Fox and Powell (2021) sought to elucidate how non-human matter affected social disadvantage and health, used the Spinozo-Deleuzian ethological approach set out in

this paper. This summary is not intended as a full study report, but merely to illustrate key aspects of the research.

Research questions

The research questions shaped the research in line with an ethological ontology:

- How do assemblages of human and non-human relations affect body capacities (positively and negatively)?
- What are the advantages and disadvantages produced by these capacities and how do these impact on health and well-being?

Data collection

Secondary analysis of two datasets: a quantitative survey of the health status of 27000 patients, recruited via GP surgeries, and qualitative interviews with a sub-sample of 45 of these respondents. The latter covered a wide range of topics using a biographical interview approach that provided relevant data for a new materialist analysis. However, the more-than-human focus in this secondary analysis did not privilege humanist concerns with attitudes, beliefs and experiences of respondents, enabling insight into the assemblages of human and non-human matter, and the affects that produced dis/advantage and ill/health. NHS ethics approval was granted for the original studies, with ethics approval for this secondary analysis obtained from the University of Sheffield.

Data analysis

NVivo was used to code the qualitative transcripts, using a coding frame similar to that set out in Box B above. Analysis of the interview transcripts revealed a multiplicity of interactions with humans and non-human matter. Human *relations* included: family members, friends and neighbours, work colleagues and employers, employees, retailers, teachers, health professionals and other service providers. Non-human matter (NHM) included housing and homes, household contents, workplace materials such as tools and office equipment, food and drink, financial resources, consumer goods, money, health products, transport and animals. Respondents also mentioned spaces and places, including local neighbourhoods, green spaces, workplaces, educational and health establishments,

sports and fitness facilities, entertainment and sports venues and named locations and businesses such as supermarkets.

The analysis enabled the authors to identify the physical, psychological, economic and sociocultural affects between bodies and NHM. Interviews provided examples of how bodies *affected* NHM. For instance, 'Jane' described using vegetables to cook meals:

> I cook vegetables on a Sunday. I buy loads of vegetables. There's loads of vegetables in fridge, but I'm always going to cook them and I never do.

NHM also *affected* respondents. 'Cath' explained how she had been physically affected by the volume of materials she had to deliver for her part-time job.

> I were in charge of one area and then I delegated to deliver the [freesheet] to others. But one day they sent me, oh thousands of leaflets. Each [freesheet] I thought, four and a half thousand houses I dealt with, and they gave me the [freesheet]with leaflets inside, and each one nearly had ten leaflets, and the garage were full of leaflets and that and we couldn't get the car in.

The analysis also documented the positive and negative *capacities* that these interactions with NHM produced. For example, 'Rebecca' described the opportunities supplied by a local open space.

> We go up to [anonymised] a lot. Obviously with horses in summer and stuff, or I'll take kids down there and we'll just brush horses and field's big so horses get chucked in one half and kids play in the other half with a football.

By contrast, teacher 'Alex' described how a change in IT infrastructure reduced her capacities to work flexibly.

> When we moved to the new school we were told that we weren't going to be provided with laptops, whereas at the other school we already had a laptop so we could come home and work at home, and we were told that the new school would be opening all hours, so we could work there.

The authors used the data to draw out from this analysis insights into how more-than-human interactions, and the capacities these produced, affected constraints and opportunities, producing relative social advantage/disadvantage. Comparisons between the capacities of those in good and poor health (based on the quantitative data in the health status survey) revealed that those in good health had higher number of positive capacities and fewer negative ones. This was reversed for those in poor health. This in turn informed understanding of the interactions between dis/advantage and health.

Discussion

Developing a social science methodology from a body of philosophical work poses specific challenges that bring into question the differing objectives of philosophy and social science research. Deleuze and Guattari (1994: 7) assert that the aim of philosophy is to create concepts with which to (re)think the world. But they also argue that a philosophical concept does not assess a specific setting or event, but instead aims to encompass a breadth of events (ibid: 33-34). Social science research has a different objective. It is less ambitious in one way, more so in another. Empirical social inquiry seeks very much to address specific events, and aims to use the research tools at our disposal to discern and make sense of data deriving from that particular moment and place. But it also aims not only to offer general insights about some aspect of the social world, but also supply a basis by which to change and improve that world.

There is a risk of eliding these differing aims when seeking to translate between philosophy and social science practice. The emergence of a skein of new materialist philosophies has offered great potential to those social scientists who have found both humanist and anti-humanist ontologies inadequate to address the fluxes of a more-than-human, relational social

world (Braidotti, 2019: 11). Some of these ontologies have been interpreted as signalling the need for an end to prescribed methodology and a concomitant need for putative researchers to immerse themselves in these philosophical sources before essaying a methodology for their intended research project. Thus, St Pierre declares (2020: 9) that '(i)n an ontology of immanence, pre-existing methodologies are impossible'. Instead, she argues (ibid: 8) that 'if social scientists want to use philosophy, they must study philosophy – there are no shortcuts. They must read carefully and slowly.'

While we agree that it is important that new materialist researchers recognise the contexts of the concepts they are using, we see this need for immersion in philosophical texts as elitist. It is based on a model of scholarly research that happens in research-intensive universities; ignores the realities of research sponsors who require detailed methodologies before releasing funds; and denies the mass of applied research by those who use social science scholarship (sometimes without an apprenticeship as a postgraduate research student) to undertake urgent and often 'just-in-time' projects to inform practice or policy. Furthermore, this elitism endangers the broadening and deepening of the community of new materialist and posthuman researchers by erecting barriers to entry.

For these reasons, as social scientists we are content to set out in this paper one approach to analysing data underpinned by the core precepts of a new materialist ontology; one that is post-anthropocentric and more-than-human, relational and contingent, immanent, and addresses a materiality that is plural, heterogeneous and emergent. Specifically, we have developed an ethological approach deriving from a Spinozist and Deleuzian conceptual toolkit of assemblage, affect and capacity, and an assemblage micropolitics of specifications, generalisations, aggregations and singular affects. It is an unashamedly simple framework: one that is practical and amenable to both entry-level and experienced new materialist researchers, and adapts some conventional methods within an innovative conceptual frame. We are fully aware that it runs counter to some other interpretations of how new materialist ontology might translate to social science research, but assert that it reflects accurately Spinozo-Deleuzian ethology, and engages with the wider discussion of 'major' and 'minor' science approaches to research. Furthermore, it is tried, tested and capable of generating novel and productive analyses, having been used to explore topics as disparate as citizenship,

climate change, obesity, sexualities, and health inequalities (Alldred and Fox, 2019; Fox and Alldred, 2013, 2020; Fox et al: 2018; Fox and Powell, 2021).

Though we are not using the concepts of assemblage, affect and capacity as philosophers, but as social scientists, we consider the philosophers of the new materialisms – not just Deleuze and Guattari, but also Rosi Braidotti, Karen Barad, Jane Bennett, Brian Massumi, Manuel DeLanda, Nigel Thrift and others – as supplying social science with invaluable tools for re-imagining the social world in the 21st century and addressing the global challenges ahead. Vital materialism, onto-epistemology, posthumanism, nomadology: these are concepts that can aid social science to ask new questions about the social world, inequalities, social justice and human futures. But as we translate these to the social sciences, and to our research endeavours, we will transform some into social scientific concepts and discard others. We will use them in new ways, to aid our enterprise as researchers to ask questions of matter, to offer novel conclusions, to develop social theory, and to inform policy and practice.

Notes

1. This conception of major and minor science has been variously embraced by Deleuzians such as DeLanda (2016) and non-representational theorists (Lorimer, 2005; Thrift, 2008), though as DeLanda (2016: 87-88) points out, classical physics is possibly the sole exemplar of a major science. Even a natural science such as chemistry has 'followed' the materiality of chemical phenomena for much of its history, rather than axiomising its subject-matter (ibid: 99). Arguably, the social sciences' lack of an axiomatic foundation means that its entirety lies within the category of minor science. However, following Deleuze and Guattari (1988: 367), perhaps it is more appropriate to acknowledge a dynamic between minor and major social sciences, with some branches endeavouring to axiomise the fuzzy findings of minor science (DeLanda, 2016: 101), while others continually undermine the certainties of major science (Deleuze and Guattari, 1988: 367). This minor/major dynamic has been played out endlessly in the continuous evolution of social research methodologies, some of which seek a social science knowledge that can reproduce the social world accurately and generalisably, while others aim to undermine such efforts and promote a social science that is contingent, inventive and reflexive about its own biases.

2. Such an assessment suggests a different take on DeLanda's (2016) analysis of 'becoming-minor' and 'becoming-major' tendencies within contemporary research (see end-note 1). Rather, it suggests that every research assemblage has within it conflicting micropolitical forces, and hence it is possible to 'engineer' these micropolitics to address the objectives of a study. Thus, if the primary aim of a study were to *describe* phenomena in the social world, research machines might be selected that minimise the aggregative effects of the research process (for instance, using descriptive case studies to report a phenomenon). If a study's aim were *analytical* (perhaps in order to inform practice, produce policy or adjudicate between alternative social interventions), more aggregative ('becoming-major') methods could provide the kind of data needed for these evidential purposes. Within a research programme, judicious mixing of methods may enable research to move between minor and major micropolitics (Fox and Alldred, 2018).

3. See, for example, Buffel et al, 2012; Popay et al, 2003; Watkins and Jacoby, 2007.

4. Secondary analysis of interviews conducted for another purpose may be used if relevant questions for a new materialist analysis were asked during the original study.

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Appendix 1

Interview schedule for research study on more-than-human relations

At work

- Tell me about your workplace.
- Can you describe the principal physical spaces that you work in? (probe: how does working in this space affect you?)
- Do you work indoors or outdoors? How does that affect you?
- Can you describe the objects in your work environment? (probe questions: furniture technologies, tools, other).
- What other spaces do you use during your working day? (probes: dining room, recreation spaces, sports facilities, toilets, smoking areas). How do these spaces affect you?
- How do the physical space and object sin your work environment affect how do your work?
- How do they affect your interactions with your colleagues?
- How do your work conditions affect how you feel (positive or negative)?
- What changes to your work conditions could improve the quality of your daily life?

At home

- Can you describe the principal physical spaces that you live in? (probe: how does living in this space affect you?)
- Do you have any outdoor space at home? How do you use this?
- Can you describe the objects in your home environment? (probe questions: furniture, technologies, other possessions).
- How do the physical space and objects in your home environment affect what you do when not at work?
- How do they affect your interactions with family members?
- How does your home environment affect your mood (positive or negative)?

- What changes to your home environment could improve the quality of your daily life?

Other activities

- How do you get around (car, bus etc)? How does this affect you?
- Can you describe the principal physical spaces that you use when out? How do these places and spaces affect you?
- What do you get from going to these places? (probe: pleasure, opportunities freedom etc).
- Do you go to outdoor places? Why do you go there? What do you do in these places? How do these affect you?
- Can you describe the objects in these indoor and outdoor spaces and how they affect you?

Anything else

- Any other ways in which places or things are important in your life?