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DATA WALKING FOR CRITICAL DATA STUDIES: AN EXPLORATIVE SURVEY OF WALKING METHODOLOGIES

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Abstract: *In recent years, a debate has emerged around the question which data competencies students in higher education need in order to be able to adequately study contemporary social and cultural phenomena. Answers to this question depend on contributors' perspectives, and range from basic and more instrumental (e.g. the ability to operationalize data for research or argumentation) to more complex and reflexive (e.g. to assess how data and its assemblages are epistemically, politically, or ethically 'entangled'). In this paper, we zoom in on the latter type of competencies, approaching them from a pedagogical angle. More specifically, we look at practices of 'data walking', exploring their affordances as a means for creating awareness of, and inciting reflection on, how data are (unnoticeably) embedded in the spaces we inhabit, and what this implies for how we live our lives and understand our world. To this end, we survey four walking varieties, paying particular attention to how they align with the objectives of the scholarly field of Critical Data Studies (CDS). In doing so, we highlight the particular educational merits of each method, but also try to round out what sort of competencies a CDS requires.*

Keywords: *data walking; pedagogies; embodied learning; critical competencies; Critical Data Studies*

Introduction

Scholars in the humanities and the social sciences have repeatedly stressed that the data we acquire, filter and sort, analyze and visualize in our data-driven research projects are not neutral samples of a reality 'out there'. Data are never 'raw' but inevitably 'cooked' (Bowker, 2005, 184; Gitelman & Jackson, 2013); therefore, we are better served calling them *capta*: 'taken', as opposed to 'given' (Drucker, 2011, 128; Kitchin, 2014, 2). As Donna Haraway taught us decades ago (1988), all knowledge is situated and partial. But in working with our contemporary society's data outputs, we easily forget this – quite possibly, because the methods and tools we use *appear* to be so objective and transparent (Masson, 2017). As media and communications scholars, we therefore take care to point out that data are necessarily abstractions, compromising the richness and complexity of the social (Langlois et al., 2015, 7 and passim) and covering up intricate connections between elements of the cultural (e.g. Berry & Fagerjord, 2017, 15). But also, that data have all kinds of bias embedded – in the sense of prejudice and discrimination (e.g. Leurs & Shepherd, 2017) but also methodologically (Marres & Gerlitz, 2016), and that we therefore need to approach them "as ontological and epistemological objects" (Van Dijck, 2017, 11).

In the past decade, highly diverse claims have been made as to the competencies it requires – from scholars and students, but also various data 'publics' (understood as in Ruppert, 2015, 136-138) – to navigate the so-called 'computational turn' with sufficient awareness of the ways in which data are entangled. Depending on who is speaking, they range from basic and more or less 'instrumental' (for instance, in the context of what is often termed 'data literacy') to more complex and reflexive; but also, from primarily technical to more critical. Arguably, the demand for specific competencies aligns with prior assumptions about the needs they serve and the objectives they fulfill. But in teaching them, we also adhere to different pedagogies – a topic dealt with much less in academic work to date.

In this article, we make a preliminary attempt to amend this situation, zooming in in the process both on a specific approach to developing competencies, and a particular scholarly agenda. In what follows, we seek to find out how different varieties of the data walk – as practiced today, and as discussed in the literature – align with the objectives of Critical Data Studies: a project singularly concerned with the abovementioned data entanglements and their various epistemic implications. Our initial assumption here is that such walks can offer a structured context for creating awareness of, and ideally, inciting reflection on, data as *capta* – in students, but by extension also others concerned with data in their daily practice. However, not all existing versions of the walk are designed specifically for this purpose. Those that are, moreover, challenge their participants in different ways. We set out here to explore whether, and if so how, each variety stimulates its participants to develop competencies instrumental to the sort of reflexive tasks a Critical Data Studies depends on.

First, we single out some of the main strands in the debate on data competencies, centering on what students and scholars need in order to be able to ‘adequately’ study different social and cultural phenomena. Our primary purpose at this point is to distinguish the sort of competencies a Critical Data Studies (or CDS) relies on, from what is often referred to in the literature as ‘digital literacy’ skills. Next, we briefly introduce practices of data walking, as they figure within both traditions of walking as an artistic and philosophical strategy, and progressive forms of pedagogy. Finally, we review four varieties of data walking, considering their overall objectives and the particular insights they seek to instill as well as the competencies they supposedly help develop. We also discuss *how* they do this: which walking methodologies they adhere to, and which pedagogical principles those methodologies in turn draw on. In the introduction to this review section, we also briefly discuss what is informally known among teachers and educational scientists as ‘Bloom’s Taxonomy’ of cognitive skills, which will allow us to better distinguish in our conclusions between the ways in which the different varieties stimulate specific *critical* competencies. We conclude with some notes on each version’s alignment with the project of CDS and the scope we see for further development. Ultimately, this should also lead to greater insight into which competencies such a project requires from its various practitioners.

Competencies for the Computational Turn

In recent years, calls for greater data competencies have been made in the popular press as well as in academic publications (see D’Ignazio & Bhargava, 2016). Commentators acknowledge that there is a dire need for such skills, but there is little agreement amongst them as to what exactly they might encompass. In debates focused on the needs of novices (students at the start of their academic careers, or journalists or activists beginning to engage with data) the term ‘data literacy’ has gained a lot of traction. However, the phrase represents just one set of views on which types of skills or competencies we need in order to be able to cope with, and benefit from, an increasingly datafied society.¹

Catherine D’Ignazio and Rahul Bhargava (2016), drawing in their definition on traditional (linguistic) understandings of the term, characterize data literacy as “the ability to read, work with, analyze and argue with data as part of a broader process of inquiry into the world” (84). In addition to understanding basic statistical principles and practices, such literacy involves being able to identify and select the data most relevant to one’s own purposes, to operate on them to extract information accordingly (by cleaning, filtering, sorting, aggregating, comparing, etc.) and then use

¹ We use the term ‘competencies’ here to refer to something more encompassing than a mere skill set, or the ability to perform (well) a number of (practical, or reflexive) acts. As we shall demonstrate later, such a notion is particularly relevant in the context of CDS.

this information to communicate a given message (D'Ignazio & Bhargava, 2016, 84; Frank et al., 2016, 5). In other words, data literacy skills are highly instrumental; therefore, the methods and tools for teaching them tend to focus on applying procedures to perform specific (mostly quantitative) operations. As Gray et al. (2018) observe, data in this case are seen as “a material to extract value from”, and as such, they argue, serve to reinforce rather than challenge existing power structures or dynamics (2).

Alternatives to this model range from those that place greater emphasis on technical, respectively scientific knowledge and skills, to those that primarily focus on critical competencies. A question that currently still dominates much of the debate is whether or not students and scholars need to learn to code (Berry & Fagerjord, 2017, 40-41). For some commentators, the answer here is a definite ‘yes’: Douglas Rushkoff (2010), to name a famous example, thinks that we need to either “program or be programmed” (that is, get manipulated by technologies, oblivious to their embedded intentions, values and biases) (128). Others, such as Wendy Hui Kyong Chun (2015), argue that programming skills may actually give people “a false sense of mastery” since “understanding code” is not the same as “understanding technology”. In these authors’ views, we should primarily learn to communicate better across disciplines – a competency that involves engagement not with the “über-skill, programming”, but rather with such foundational disciplines as statistics, or mathematics, whose concepts and knowledges our digital tools are profoundly informed by (Rieder & Röhle, 2017, 111).

Observers at the other end of the spectrum are primarily concerned with the critical competencies required for reflective engagement with our contemporary datafied society. This is true among others for many who work in the loosely-delineated field of Critical Data Studies. Such concern, of course, does not entail that technical or scientific knowledge are considered irrelevant. CDS, born from the need for a “systemic approach to data criticisms” (Dalton & Thatcher, 2014), tracks “the ways in which data are generated, curated, and how they permeate and exert power on all manner of forms of life” (Iliadis & Russo, 2016, 2). Practitioners do this by exploring so-called ‘data assemblages’ (Kitchin & Lauriault, 2014; Iliadis & Russo, 2016, 2) – a task that arguably also requires understanding of the “mechanisms and operational logics” of relevant technologies (Bucher, 2018, 61). But critical data scholars’ key concern is with the epistemologies, politics and ethics of data: its generation, circulation and use, but also the methods and tools for studying it. While the questions they ask range widely in terms of focus and perspective, the work they do invariably hinges on an ability, but also a preparedness, to question powerful but largely invisible forces (a point we come back to in our conclusions).² It is this kind of competence which, according to proponents, is overlooked in most pleas for increased data ‘literacy’ (see for instance Gray et al., 2018; compare also Markham, 2019, 3-4).

In this article, we depart from the assumption that answers to the question which competencies are needed, are informed by diverging views on what they should help accomplish. For this reason, we do not consider one set inherently more, or less useful than another. Yet in light of our upcoming exploration, we do take a special interest in the sort of competencies needed for critical engagement with the data assemblages that CDS is concerned with. As it happens, none of the literature on the topic lays out *what exactly those competencies are*. We hope therefore that what we do here will also provide some initial pointers in this direction, as a starting point for further discussion.

Finally, we want to specify that in what follows, we focus on what the different walking methodologies have to offer, specifically, to students in higher education who have elected to study

² Rob Kitchin (2017), dealing specifically with different perspectives for the study of algorithms, gives a sense of the range of questions asked.

aspects of contemporary (digital) culture – even if they may be fruitful also for others outside this category. Over the course of the past one and a half years, two of us have been organizing a number data walks for students and colleagues in the Utrecht University (the Netherlands) Department of Media and Culture Studies. So far, those walks have been highly explorative, in response to our wish to experience first-hand the different varieties of the walk, and how they might benefit our CDS-inspired teaching or research.³ In the future, we will be building on this experience, as well as on the analysis below, in designing iterations of the walk that align more tightly with the specific profiles and learning objectives of different student groups and courses.

Walking Pedagogies

As Rebecca Solnit established in her well-known book *Wanderlust* (2000), walking can be performed for pleasure, but also as a critical, political or aesthetic practice. Keith Bassett (2004), building on her work, zooms in on the latter, delineating a particular urban tradition of such walks. This tradition extends from the strolls of “the nineteenth-century *flâneur*, through [...] the ‘*déambulations*’ of the Surrealists, the urban explorations of Walter Benjamin, the ‘*dérives*’ of the Lettrists and the Situationists, [...] to the recent psychogeographical expeditions of London-based writers such as Ian Sinclair” (398). While the movements he chronicles involved mutually distinctive walking practices, “different aesthetic, critical and political strategies; and, implicitly, different forms of epistemology and ethnography” (ibid.), they also shared a basic assumption: that the act of walking plays a key role in propelling reflection. And specifically, reflection on that which ordinarily tends to be *ignored* (Powell et al., 2018, 149).

Acting upon the same hypothesis, authors since have also speculated on the particular educational potential of walking. In the editorial to a recent volume on embodied and walking pedagogies, Snepvangers et al. (2018) note a renewed academic interest in the topic. They associate the development with the increasingly prominent role of new technologies in research practice, which in their view has led to “greater awareness of what it means to know, [...] how we come to know and what might be possible through pedagogies to enable others to come to know” (1). It leads them to positioning acts of walking as a possible route towards greater awareness and understanding, for both students and scholars.

This reasoning ties in with a broader set of ideas in educational science, and specifically, work on human cognition. Since the beginning of last century, reformist pedagogues across the globe have experimented with more active and experiential teaching methods. Key to those methods is the assumption that pupils and students learn best in a hands-on manner, at their own initiative (that is, with the teacher or instructor acting as facilitator rather than source of knowledge) and building in the process on concrete experiences acquired in ‘real-life’ situations (Masson, 2012, 37-41). Such ideas were developed further in the 1970s, in the context of experiential and constructionist theories of learning (e.g. Kolb, 1984, resp. Papert & Harel, 1991). In addition, advocates of data walking also pick up on the interest of early reformists in the role of the senses (Masson, 2012, 37-38, 266) and stress the corporeal aspects of learning. Oftentimes, they find justification for their approaches in theories of embodiment (e.g. Snepvangers et al., 2018, 2-4).

However, it is crucial to note here that for walking proponents, this emphasis on the sensory, the experiential, the situated and the hands-on, does not detract from the practice’s reflexive potential. From the perspective of embodied pedagogy, acting, experiencing, perceiving, knowing and understanding are closely interconnected; in the act of knowledge construction, body and mind

³ Karin van Es organized the Utrecht walks, assisted in the process by student Vivette Rittmann, and later on joined by Maranka Wieringa. Her initial thoughts on the potential of the walk for research will be discussed in Es & Lange, forthcoming.

join forces (Nguyen & Larson, 2015, 332). Inspired by such ideas, Snepvangers et al. (2018) argue that walking engenders a cognitive process that is “experiential, collaborative, and mediated, but also internal and deliberately reflexive” (3). Bassett (2004), in a piece on the practice’s affordances for social geography teaching, explains how such reflection in turn can become *critical*. His walking experiment demonstrates how it can help undermine taken-for-granted experiences and ideas, and raise issues about epistemology and methodology (408). The sort of reflection it invites is one of critically interrogating everyday assumptions, conditions and habits – including also the walkers’ own (compare also Snepvangers et al., 2018, 4-5). Arguably, such reflection is key also to practices of CDS; we therefore return to it below.

Data Walks: Objectives, Design, Learnings

As we previously intimated, the varieties of data walking developed so far differ amongst each other in their objectives as well as their design. Even if awareness raising is a stated objective for each of the walks we discuss, not all of them were conceived specifically, let alone exclusively, for use in a formal (higher) education context. (Some were, and in a few cases, a walk was even designed or adapted for application as part of a specific course unit.) Therefore, a number of them require at least some modification in order to be suitable for use in this particular context. In what follows, we take a closer look at four walks that are considered (by their developers) to have potential for educational use, and that have at the very least been tried out also with students. A fifth one is included in the schematic overview in figure 2, but not discussed at length here.⁴ In all cases, we consider the walks from the perspective of the pedagogical potential they already offer – whether as used with students or among scholars, or in other professional contexts.

In this section, we first discuss each walk in terms of its overall goals, among others in light of the particular assumptions about our datafied reality it is inspired by. Next, we review its key features: its make-up, also in relation to the larger event a walk is part of, and what this reveals about the particular insights or competencies it is designed to instill in participants. Finally, we consider *how* it does so; that is, which basic pedagogical principles it adheres to in the process, and what this says about how the learning process is envisioned. We do this in the order that best suits consideration of the relations between them. For reasons of space, we cannot discuss all the data that we have gathered for this purpose, but we include some additional specifications for each walk in a schematic overview (see figure 2). In our conclusions, we then evaluate to what extent the different walking methodologies challenge participants to develop the sort of competencies that are also key to CDS’ reflexive practice.

In order to be able to do this, we need some vocabulary that helps us specify the particular cognitive skills involved. We derive this vocabulary from what is often referred to as ‘Bloom’s Taxonomy’: a hierarchical classification system for learners’ thinking at different levels of cognitive complexity. Developed in the US the early 1950s, it was primarily designed to enable communication about the specific student behaviours that educational processes aim for (Bloom et al., 1956, 12). Despite its age, teachers and scholars at all levels of education still rely on it, especially for purposes of content and curriculum development, instruction and assessment, and in educational theory (e.g. Seaman, 2010-11, 30-31; Adams, 2015, 152). In this article, we reference the 2001 version (Anderson & Krathwohl, 2001) which aside from introducing an adapted terminology, also enriched the taxonomy with a knowledge dimension and placed more emphasis

⁴ Adam Greenfield and Nurri Kim’s Systems/Layers walkshop, to our knowledge, was never tried out in a (formal) educational or scholarly setting. However, it functions as a reference point for other developers, and therefore, we do list its theoretical inspirations and key features in our schematic overview in figure 2.

on the non-sequential nature of the cognitive levels, which also overlap in terms of constituent features (Forehand, 2010, 42-44; Seaman, 2010-11, 36-37).

In our conclusions, we use Bloom’s terminology selectively, as we primarily seek to pinpoint the particular higher-order cognitive skills that the different walks stimulate. Over the course of time, a measure of consensus arose that the six levels of complexity the taxonomy identifies (see figure 1) can be subdivided into ‘lower-level’ skills (to remember, understand and apply) and ‘higher-order’ ones (to analyze, evaluate, create), and that it is those higher-order skills that critical thinking relies on (Adams, 2015, 152-153).⁵ Additionally, we draw on some of the distinctions the 2001 taxonomy makes between types of knowledge, specifically the ‘conceptual’ kind (which, if we translate it into competencies, entails the ability to use concepts, theories and models productively) and the ‘meta-cognitive’ kind (which intersects with the capacity to self-assess). We elucidate those categories later, as the need arises.

← Types of Knowledge	Cognitive Skill Levels →					
	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual						
Conceptual						
Procedural						
Meta-Cognitive						

Figure 1: diagram of key concepts in Bloom’s Taxonomy (based on the 2001, revised edition)

Alison Powell’s Data Walkshop

A first data walking variety we want to look at is the one developed by Alison Powell, a media and communications scholar based at the London School of Economics, UK. Initially, in the mid-2010s, Powell primarily explored the walk’s affordances as a teaching tool: as a means to give students a “physical, spatial and sensorial experience of [...] data proliferation” (Powell, 2018, 214). Later on, she also developed it as a method for research creation, and even as a public engagement strategy (219ff).

Her version of the walk is heavily inspired by the ‘Systems/Layers’ walkshop, initiated in the early teens by urban theorist Adam Greenfield and artist Nurri Kim. ‘Systems/Layers’ was born from a desire to create understanding of what they called ‘networked urbanism’ (a set of transformations due to the ubiquity of networked information-processing systems in today’s urban environments; see Greenfield, 2009) and how it impacts on our freedom to move and act, which in their view is “vital to full citizenship” (Greenfield & Kim, 2011, 2). Powell’s walk resulted from a similar dissatisfaction as Greenfield and Kim’s with the tenor of contemporary debates about the smart city (cf. Greenfield, 2013) and can be seen as an effort to critically intervene in them (Powell, 2018, 217-219). But in contrast to its model, it is also inspired by ethnographic practice. Powell conceives of her walkshop as a “radically bottom-up process of exploring and defining data, big data and data politics from the perspectives of [...] citizens” (213), which leaves room for the production of “situated, everyday, emotional or non-expert knowledge” about data (229). Unsurprisingly, then, it is in circles of data ethnographers that this variety has been adopted the most fervently (for instance, by Fiore-Gartland et al., 2017).

⁵ The position of ‘applying’, within this dichotomy, is variable, and at times, it is even seen as a separate (third) category (e.g. Stanny, 2016, compare for instance sections 1 and 3). It has also been argued that all levels of thinking in Bloom’s Taxonomy involve *some* form of critical thinking (ibid.). Here, we take the (broadly shared) view that critical thinking involves all cognitive skills in the taxonomy, but relies more heavily on the ‘higher-order’ ones.

Compared to Systems/Layers (see figure 2, first column), the Powell walkshop is more tightly structured, while at the same time leaving its participants more freedom both in terms of which elements in the environment they focus on, and what they reflect on. Ordinarily, participants first have a group discussion about what data is, and then, in smaller teams, identify specific ‘matters of concern’ to centre on in their journeys (Powell, n.d.). Afterwards, the groups reconvene to tell each other about their respective strolls, constructing in the process “a narrative for how they define and critique data in place” (Powell, 2018, 213). Specific about the Powell walk is that participants, in observing and documenting data encounters, take on predefined roles (see figure 2) – an approach inspired by Laura Forlano’s (2010) ‘flashmob ethnography’. Yet the walk itself unfolds in a highly unrestrained way. Participants can freely choose where to walk, and – unlike in the Greenfield and Kim case – need not even focus in the process on ‘data rich’ areas (Powell, 2018, 213). Examples of possible ‘matters of concern’ are the intersections of data with surveillance, social justice and discrimination; the construction of value in the context of trade; or, the creation of a data commons (Powell, 2018, 213; Powell et al., 2018, 147).

An overarching rationale for the Powell walk is that participants gain insights collaboratively and in non-hierarchical ways (e.g. Powell, 2018, *passim*). The specific build-up of the event also serves to highlight the need for epistemological reflection, specifically on the observers’ own role in rendering the world they experience, ‘live’, *into* data (Powell, 2018, 214-215; Powell et al., 2018, 147-148). In practice, Powell relates, participants oftentimes confront the unknowability and inscrutability of data assemblages, and sometimes, they even self-consciously create (alternative) data of their own, in reaction to it (Powell, 2018, 223, 225). Such activity not only fits well with the sort of bottom-up data ethnography that Powell advocates, but is also illustrative of the intentionally performative character of her walk. Ultimately, Powell’s goal is for participants to “use the [...] ethnographic data they collected to produce (future) interventions in the city spaces they observed” (217), possibly using strategies appropriated from ‘critical making’ (Powell, 2018, 216; Powell et al., 2018, 147-148). But by encouraging participants to focus in the process on their own (shared) concerns, she more implicitly also subscribes to ideas from progressive pedagogy, especially regarding the connection between successful learning and the relevance of what is learnt to one’s own life.

The Action Research Walk from the Centre for BOLD Cities

About three years ago, another walking variety began to be developed at the Centre for Big Open Linked Data (BOLD) Cities, led by sociologist Liesbet van Zoonen at Erasmus University in Rotterdam, the Netherlands (Schokker, 2018).⁶ Much like Powell’s, this project is part of a broader effort to counter contemporary smart city discourse. The BOLD team was inspired by observation of the uneven power balance between different stakeholders in urban big data (Zoonen & Hirzalla, forthcoming) and set out to “enhance [its] civic and social uses” (Zoonen et al., 2017). To do this, it developed a number of educational products for municipalities, such as lectures, workshops, and a data walk. We focus here on the walk, which has been conducted with different groups of participants: city employees, but also other ‘city-users’, including students (*ibid.*).

The action research walk, while strongly influenced by Powell’s, is also quite distinct from it – primarily in that it involves *two* sets of ‘learners’. On the one hand, there is the city-users, the primary participants in the event. Arguably, the walk’s set-up is strongly inspired by the team members’ original focus on civil servants, who in their view need to “strengthen their role as defenders of city values and public goals amidst the variety of stakeholders” in smart cities (Zoonen & Hirzalla, forthcoming). This requires in turn that they become more profoundly aware

⁶ The Centre is a collaboration with the universities of Leiden and Delft.

of data, but also acquire a more critical, interrogative attitude towards it. On the other, there is the organizers, who also partake in the walk, but primarily in order to *observe* the participants, who at once serve as research subjects. Applying a form of participatory action research, they gather anthropological data to examine “knowledge and beliefs about digitization and datafication” (ibid.). They do this in order to develop new strategies and tools for stimulating participation and engagement, often among subjects with diverging interests (Zoonen et al., 2017).

Another key difference with Powell’s initiative is that the BOLD walk is more “directive”, in that participants are actively challenged to ‘see’ data and answer specific questions about them (Zoonen & Hirzalla, forthcoming). Unlike in the previous case, the route for the walk is plotted beforehand (Schokker, 2018). As the participants start walking, the organizers act as moderators, asking questions about the visibility of data, its applications and ownership, and the nature and extent of municipalities’ responsibilities in relation to them (Zoonen & Hirzalla, forthcoming). At times, they also prompt the walkers to reflect on potentially relevant objects, which they researched in advance (Schokker, 2018). In this case, it is also the observers – not the participants – who take notes (Zoonen & Hirzalla, forthcoming) and who ostensibly benefit from the walk’s documentation. Follow-up reflection within the entire group takes place, but is quite brief (Schokker, 2018).

Considered from the participants’ perspective, the BOLD walk is certainly less ‘open’ or ‘bottom-up’ than Powell’s, in that the walkers are given less ownership of their narrative for defining and critiquing data. Not only do the organizers take a question-led approach (which serves to frame, and hence constrain the exchanges that unfold), they also act on rather specific presumptions about what it is that participants ‘lack’ in terms of knowledge or perspective (for instance, an understanding of datafication as a social, rather than an individual responsibility; see ibid.) and how to compensate for it. The main benefit for the walkers is a basic ‘data awareness’: an appreciation that “there is a lot more to know, understand and judge about the data in their city than they thought there is” (Zoonen & Hirzalla, forthcoming). In contrast, the observers have rather specific (and original) insights to gain, specifically on discourses about data and its infrastructures – a topic also relevant in the context of CDS (see Iliadis & Russo, 2016, 3). We return to this point in our conclusions.

David Hunter’s Data (Mapping) Walk

The third variety of data walking, developed around 2016, is distinct from the previous two in terms of its disciplinary context. Devised by David Hunter at Ravensbourne University, London, UK, it specifically targets students and professionals in graphic, interface and experience design. It is inspired conceptually by a notion of the city as a “rich, multilayered ‘dataspace’” (Hunter, 2018, 12) and its objectives are twofold. First, the walk intends to stimulate in participants an explorative attitude: a preparedness to go out and discover, and get to know, their day-to-day environments by gathering and processing data about them (ibid.). Second, it is designed also to teach data literacy (16). As the set-up of the walk suggests, this latter objective is key: it primarily enables participants to try out methods and tools for data gathering and visualization, in order to gain insight into their different affordances.

In terms of how it is conducted, the Hunter walk is at once more, and less well-delineated than those already discussed. On the one hand, it is part of workshop, lasting at least a day, which consists of a number of distinct stages. After a preliminary briefing, the participants form groups and decide on the themes they wish to pursue. (In this case, those are understood quite simply as the phenomena to gather data on: e.g. flora and fauna, pollution, security or architecture.) Technical preparation follows, and then the walk itself, which is focused on data collecting and

involves the participants' choice of tools and techniques. Next are the stages of 'data wrangling' and 'visualization', once again using appropriate hard- and software, and presentation of the projects conducted (Hunter, n.d.; Hunter, 2018, 34-45). On the other hand, both local organizers and participants are free to determine where they walk, how many times, whether in a predetermined area or not, and in terms of what they focus on in the process (Hunter, 2018: 14, 46-51). Moreover, in as far as it concerns the data's visualization, participants are encouraged to be creative and innovate, looking to data art practice as a source of inspiration (18-19).

Hunter, much like other developers, sees the walk primarily as a means to 'engage': to make data serviceable to the common good by turning it into knowledge, thus inspiring action (Hunter, 2018, 10, 4). In practice, however, the participants primarily learn to use data to communicate messages (or in the developer's terms, 'stories', 48) – a key objective, indeed, of data literacy teaching. While they also need to "understand what data is" (16), this is at the rather instrumental level of being able to assess either its accuracy, or specific tools' trustworthiness or appropriateness to particular expressive goals (*ibid.*). As far as we can tell on the basis of published materials, the walk does not encourage more encompassing critical scrutiny of our datafied reality, or of how it is 'knowable' (also through acts of data wrangling and visualization). However, we do wish to note that Hunter's learning-by-doing approach is highly stimulating for participants. This seems due to a combination of at least two factors: a focus on the walkers' own interests (thematically, and in terms of the chosen tools) and the fact that they have autonomy over their learning process – a point of concern also in the workshop itself (12).

Malte Ziewitz' Algorithmic Walk

A last variety we want to mention is the algorithmic walk, conducted in experimental fashion by Malte Ziewitz at Cornell University, US, since 2011. Ziewitz, active in the field of Science and Technology Studies, is interested in how algorithms serve as 'figures' (after Castañeda, 2002, and Suchman, 2012) to make sense of observations in a range of fields (Ziewitz, 2017, 2). The walk's purpose is to explore "what kind of work our reasoning with algorithms does" (3). Its approach is inspired by what Lezaun et al. (2013) term 'provocative containment': a social-scientific technique combining "experimental and ethnographic sensibilities" (3-4). The idea is that participants, in enacting the figure of the algorithm, encounter all kinds of "trouble for analytic purpose" (4) and begin to rethink widespread understandings of algorithms (for instance, in terms of their impact or ethics).

The walking event starts off with discussion among the participants to decide on the foundational algorithm(s) for determining the terrain walked.⁷ During the walk itself, this algorithm is constantly respecified, and ideally, this triggers reflection on where it begins or ends in relation to the environment, but also on the walkers' own practices of observation and decision-making (Ziewitz, 2017, 10-11). As it is in the nature of algorithms to be tailored to specific needs, the walk also centres on a predefined problem, as determined by the participants (5).

As a result, the algorithmic walk is heavily constrained – but this constraint is both self-imposed by the participants and subject to change. Moreover, Ziewitz' approach invites reflection not only on the parameters of the walk, but also, much more fundamentally, on the "contingencies that come with using algorithms as a figure to account for practice" (2). Learning is understood here as an experimental, playful process, emerging from the very situations where the object of reflection – a particular form of reasoning – takes shape. Much like the one developed by the

⁷ Arguably, this approach is indebted to the Situationist *dérive*, as explored further 'algorithmically' in the context of data art (see for instance Mul & Masson, 2018, 183-4).

BOLD team, the walk benefits both the walkers and the researcher (and sometime participant) who observes their deliberations. In terms of learning outcomes, however, there is less of a difference here between the parties involved.

	Greenfield and Kim's Systems/Layers workshop (*)	Powell's data walkshop	Action Research walk @ Centre for BOLD Cities	Hunter's data (mapping) walk	Ziewitz' algorithmic walk
Objectives, as stated by authors (= organizers' perspective)	To create understanding of how 'networked urbanism' affects freedom and citizenship	To raise awareness and create bottom-up knowledge of (big) data, processes of datafication and their politics	- In participants: to create awareness of and nurture a critical attitude towards data, its ownership and its (public) affordances; - for observers: to gain insight into knowledge and beliefs about digitization/datafication	To enable experimentation with tools for data gathering and visualization, and in the process, stimulate understanding of one's (overall) environment	To create (participants) and gain (organizers) understanding of algorithms as a device for making sense of observations
Objectives, reformulated in terms of competencies to be acquired (= participants' perspective)	To notice otherwise unnoticed elements in (urban) space; to reflect on the implications of what they represent, in political terms (issues of power and control)	To notice (and making perceptible) invisible data assemblages, to imagine and perform alternative ones; to reflect on the politics, ethics of datafication; to reflect on own process of observation and data/knowledge production	- For participants: to notice data and its ownership; to reflect, esp. on (the limits of) one's own understanding in relation to data; - for observers: to reflect on (deconstruct) discourse about data (as observed in participants)	To practice data literacy skills (incl. skills in the use of specific tools); to cultivate explorative attitude (in relation to one's environment)	To reflect on the nature of algorithmic reasoning (and rethinking widespread concerns, e.g. about the impact and ethics of algorithms)
Theoretical framework	(Critical) theories of urbanism, ubiquitous computing, and ('smart') citizenship	(Critical) theories of urban mediation and ('smart') citizenship; (feminist) epistemology; etc.	Theories of symbolic power (esp. Bourdieu's power as resource vs. discourse, via Everett & Jamal, 2014)	Key notions: city as 'dataspace'; 'generative' design	STS, specifically the idea of 'figuration' (e.g. Suchman, 2012)
Methodological inspiration	[Unspecified]	Critical making perspectives; Forlano's (2010) 'flashmob ethnography' (roles)	Participatory action research design; ethnographic methods	Iterative design; data art practice	Garfinkel's (1967) ethnomethodology; Lezaun et al.'s (2013) 'provocative containment' technique
Location of walk; duration of walk / event; number of participants	Predetermined area ('the box'); 90 mins. / 150 mins. to several hours; max. 30, with 2 groups of up to 15 + Repeat walk possible (after week/month)	Not predetermined; 45 mins. / half to full day (and more); about 15, with 4-5 per team	Predetermined route; 60 mins. / ca. 90 mins.; 4 to 7 (ideally 5) + Walk may be part of larger programme (with lectures, etc.) + Possibility of repeat walks being explored	Varies (more / less predetermined, enclosed); varies (45 mins. and up) / varies (one or more days); [unspecified], in small teams + Repeat walks (same-day, and over time) possible/desirable	Area determined 'algorithmically' by participants (= arbitrary yet rules-based); e.g. 120 mins. / [unspecified]; 2 or 3
Group composition (type of participants)	Mix of local experts ('mayors') and domain experts (non-locals; people with basic insight in networked informatics)	Originally students; more recently also researchers, activists	Civil servants, city users + In different role: researchers (= observers)	Students, professional designers, others	Students and/or scholars
Event make-up (phases)	Walk (incl. photographic documentation) – discussion (incl. mapping of route walked) + After event: online documentation and	Discussion (preliminary definition of data, identification of theme and group formation) – walk (incl. documentation) – discussion (development of narrative for defining and critiquing) – (ideally) critical making activity	Briefing (discussion of goals and concept of walk) – walk – short follow-up discussion + Debriefing for researchers, based on documentation	Briefing (introduction to workshop) – discussion (group formation and identification of themes) – walk (incl. data gathering) – data wrangling and visualization –	Discussion (setting of rules for walking) – walk (incl. note-taking) – discussion (reporting on experiences)

	follow-up			presentation of project results	
Participant roles	None; participants walk with organizers (as facilitators)	Navigator, photographer, map-maker, note-taker, collector	None; participants walk with organizers (as moderators and participant observers)	All participants take part in data gathering (using wide range of possible tools), wrangling and visualization	May involve a navigator (with participants taking turns)
Other significant features		Theme-led (focus for knowledge creation); production of a narrative (through mapping, etc.); performative aspect (possibility of urban interventions)	Question-led	Theme-led (focus for visualization); production of a 'story'	Problem-led
Underpinning pedagogical principles (how the learning process is envisioned)	Learning as process with +/- well-defined end, requiring strong guidance from facilitator; learning as playful experience	Learning as process of discovery, interest-led and playful; knowledge production as a collective, non-hierarchical process; emphasis on material/bodily features of cognition	Learning as process of self-discovery (confrontation with own 'lacks'), requiring strong guidance from facilitator	Learning as active, experimental, discovery-based process (involving reflection on process and evaluation of one's learnings); learning as collaborative and peer-to-peer	Learning as experimental, playful process, taking place <i>in situ</i>
Key cognitive skills / type of knowledge relied on (Bloom's Taxonomy)	(At least) apply, analyze, evaluate / conceptual knowledge	Analyze, evaluate, create / conceptual (+ meta-cognitive) knowledge	- Participants: apply, analyze / conceptual knowledge; - observers: analyze, evaluate / conceptual knowledge	Remember, understand, apply (+ analyze) / procedural (+ conceptual) knowledge	Analyze, evaluate, create / conceptual (+ meta-cognitive?) knowledge

(*) This variety is not discussed separately in the main text, but referenced in the Powell workshop section.

Figure 2: schematic overview of data walks' key features

Reflections and Conclusions

Comparison of the four walking varieties discussed inspires some preliminary conclusions. First, the Powell and Ziewitz' walks arguably tie in the most directly with the concerns of CDS – both in terms of the specific issues they are inspired by and their overall theoretical framings (see figure 2, row 1 and 3). Both authors emphasize the questioning or challenging of taken-for-granted assumptions about data or algorithms, either during the walk (Ziewitz) or in follow-up to it (Powell). The Hunter variety, while also encouraging a basic form of tool criticism (e.g. Es et al., 2018), is primarily focused on collecting and arguing *with* data. The BOLD version, while inciting reflection on a topic relevant to CDS (data discourses) reserves this privilege to the people organizing the walk. (However, a variety that transfers this responsibility to students is certainly imaginable.) In addition, the Powell and Ziewitz events centre on the sort of critical themes, often political or ethical in nature, that CDS is concerned with. All walks require some form of engagement with data infrastructures – understandably so, as they all involve exploration of a concrete space, in which such infrastructures are inevitably embedded. However, it is Powell's (along with its model, Greenfield and Kim's) which most obviously positions those as socio-technical constructs, which as Gray et al. (2018) put it, “organize and instantiate *relations* between people, things, perspectives and technologies” (10). Relations which, they argue, current discourse on data literacy largely ignores (ibid.).

Second, those same varieties most obviously foreground the sort of competencies that CDS practice supposedly relies on. As previously stated, none of the relevant literature explicitly discusses this topic; however, most of it at the very least implies that it is about more than just the ability to perform operations *with* data – the focus, indeed, of much data literacy training. In addition, it intimates that CDS, beyond mere skills (in the commonsense meaning of the ability to

do something, or do it well) also requires specific attitudes and sensibilities.⁸ Arguably, all data walks confirm this, in that they invariably appeal to a certain preparedness in their participants to attend to objects, phenomena, or factors that usually remain unnoticed (for instance, because they are invisible or otherwise liminal). The Hunter walk for its part also sets out to cultivate an explorative attitude, understood here as a fundamental willingness to investigate issues, ideally on the basis of data gathered for the purpose (instead of searching for ready-made answers online; see Hunter, 2018, 12). However, what sets the walking varieties apart is the extent to which they also rely on participants' critical faculties – or rather, the complexity of the cognitive skills involved. This is where Bloom's Taxonomy is of use.

As previously mentioned, the taxonomy's users tend to act in the assumption that critical thinking requires such 'higher-order' skills as analyzing, evaluating and/or creating – skills that each add a layer of complexity to, but also build on, the 'lower-level' skills of remembering, understanding and applying (see figure 1). Even educational scientists do not always agree on how said categories are best interpreted and used (see e.g. Stanny, 2016). However, their combined assessments do allow for some basic inferences about the skills level each walk targets.

The Hunter one, for instance, leans heavily on lower-level skills: applying knowledge (facts and functionalities, as remembered from the preparatory stages of the event) and understanding it. Moreover, it mostly involves procedural, rather than conceptual knowledge – a key distinction for the purpose of CDS. Versions of the walk with a basic tool criticism dimension are arguably more reliant also on analytical skills, and may even involve some conceptual discussion. In the BOLD walk, the main objective for participants is to gain greater 'awareness' of data and the issues it raises. Arguably, then, it requires recognition of such issues, but also of their relevance to specific situations: tasks that rely on conceptual knowledge and its application and/or analysis (see Stanny, 2016, 5). If considered from the observers' perspective, the same walk also requires profound evaluative skills. With the Powell and Ziewitz walks, then, the emphasis shifts further up the cognitive skills ladder. The Powell one largely builds on existing conceptual knowledge and understanding of a wide range of issues and debates. Participants need to consider those analytically and evaluatively, but they ideally also creatively *transform* them (for instance, in the context of interventions in a particular data space). The Ziewitz variety is equally reliant on 'higher-order' cognitive skills – even if those are mobilized here for critical engagement with a single, specific phenomenon. In sum, all walks discussed offer opportunities for developing competencies that CDS relies on; however, it is the last two that revert more radically the sort of critical skills that distinguish such practice from much other engagements with data and its infrastructures.

A third way of evaluating the different walking methodologies is from the perspective of how they envision the learning process (see figure 2, last row). As we discussed, walking proponents often highlight the advantages of active, experience-based, collaborative learning. Within the broader ecology of critical data methods that have emerged over the past decade, there are others that fit this bill at least to some extent. Among them, the data walk stands out because of how it takes practitioners out of the isolation – and quite literally, the secluded spaces, such as classrooms – in which they tend to apply them. For instance, some varieties of the data sprint (Venturini et al., 2017 et al; Munk et al., 2020) that involve the performance of a form of 'critical' analytics (as in Rogers, 2018) also require hands-on engagement, stimulate collaboration in groups of people with different expertise, and draw the participants' attention to the relatedness of data generation, circulation or usage to their own social (media) lives. The walk, however, can do all of those things and *more*: by sending learners out onto the streets, it additionally confronts them with the entanglement of said processes with their physical and lived environments. A second point of

⁸ Markham (2019) makes this point more explicitly (albeit in a slightly different context), highlighting also the relation between a (critical) curiosity and the preparedness to develop specific competencies (p. 3).

comparison are approaches which, link some of the walking varieties discussed, involve the use of ethnographic research data or methods and/or are more interventionist in nature. Examples are ‘stitching’ (as discussed in Blok et al. 2017), respectively practices of critical making (quoted by Powell as a key methodological influence) or placing digital methods in ‘critical proximity’ with political practice (see Madsen & Munk, 2019).⁹ However, none of those approaches take advantage of the specific benefits that walking, as an embodied act, is considered to bring to the learning process.

If we compare the different varieties discussed here *amongst* each other, there is a marked difference in terms of the role they assign the walkers in determining how this process is conducted. In the BOLD walk, for instance, there is a facilitator (organizer/observer) who sets the parameters for acquiring the ‘awareness’ the walk centres on. The others in contrast rely more heavily on the walkers’ initiative – even if adhering to strict ‘rules’, such as the Ziewitz one – and view learning as both more playful (all) and either peer-to-peer (Hunter, Ziewitz) or purposely non-hierarchical (Powell). In addition, the last three have in common that they leave participants a lot of freedom, either in terms of which methods or tools they want to become proficient at (Hunter) or which themes or problems they want to reflect on (all three). We might even argue that at least one (Powell) also involves choices and decisions reliant on what Bloom’s Taxonomy terms ‘meta-cognitive’ knowledge: insight into how cognition works and how one can take control of it and regulate it (see Anderson and Krathwohl, 2001, 55-56).¹⁰ In our view, those last few observations are key, as they account for much the motivational potential of the walks as pedagogical tools.

As we previously mentioned, two of the article’s co-authors have recently begun to conduct different versions of the walk at Utrecht University, initially with broadly composed groups of interested staff and students (the latter mostly collaborators of the Utrecht Data School, an initiative that involves students in commissioned research involving data analysis; see Schäfer et al., 2018). Later on, they also began to explore its affordances in the context of specific courses – a practice they are now trying to streamline, so as to be able to better align the walk’s features with the educational objectives of specific (CDS-inspired) programme modules and the needs of students at different stages in their academic careers. We hope to be able to report on the outcomes of this process in the near future.

Overall, however, our experiments with students so far have tended to build primarily on the Powell model for the walk. In light of the above, this is hardly surprising, because in its present form, it is most in line with the objectives of CDS – both in terms of the theoretical frameworks and methodologies it draws on and the critical competencies it involves. In addition, it also gives students a lot of ownership over their learning process, and due to the scope it allows in terms of reflection topics, it is highly ‘durable’ (to the extent even that it is possible to undertake different walks with the same group of participants several times over). However, a point of attention for all varieties including Powell’s is their open-endedness, which can lead to a lack of commitment on the walkers’ part. The BOLD team, in conducting a student-version of the walk, noticed “boredom setting in quickly” – a circumstance it attributed to the lack of connection in this group with the walk’s (predetermined) focus or message (Zoonen et al., 2017). The Powell walkshop, which leaves it to the participants to choose a theme, eliminates this problem. But even so, experience teaches, discussions can easily ‘plateau’ and even come to halt; for instance, if the walkers get stuck in an exchange about how to define data. For this reason, we tend to try and structure the walk a little more tightly than Powell does, phasing the walk around a larger number

⁹ Many thanks to one of the anonymous reviewers of this article for the latter two literature suggestions.

¹⁰ The BOLD walk, while intent on teaching participants that their data awareness is limited, does not necessarily involve scrutiny of those limits, or reflection on how they can be extended (which seems key for Anderson and Krathwohl).

of distinct, reflective tasks. Arguably, this stimulates participants to keep digging deep – and in the process, continue to activate the ‘higher-order’ cognitive skills that CDS is so dependent on.

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