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I will be dealing here with a particular mark: the mapped trace of movement. The best known of several satellite navigation systems,ⁱ the Global Positioning System (GPS) is the most significant of a number of technologies that have led to what human geographer Nigel Thrift calls a “generalised capacity to track movement” (2011, p. 7), and as GPS functionality has become increasingly commonplace in mobile digital devices like phones and cameras, it has been employed in a number of new mapping practices. These range from the everyday creation and sharing of what has been called “geomedia,” such as photographs with geographic metadata to index them to particular locations and make them searchable using a map interface (Lapenta, 2011; Thielmann, 2010), to more ambitious endeavours like a collaborative attempt to produce new street mapping with global coverage, free of copyright restrictions (OpenStreetMap).ⁱⁱ Among these new mappings are many created under the heading of art: so many, in fact, that a genre category – locative media – was coined to label this burgeoning field in the early 2000s. These mapping practices have been drawn on to support claims that geospatial technologies are contributing to new understandings of cartography as processual, performative and embodied, rather than representational (Crampton, 2009; Kitchin, Perkins, & Dodge, 2009; November, Camacho-Hübner, & Latour, 2010; Perkins, 2009).

Among the many applications of GPS, one of the simplest is the ability to create a linear trace of movement. Despite its simplicity, this mark is at the core of the collaborative cartography of OpenStreetMap, and it is also a motif of much of the art that uses GPS. My position here is that artworks that employ this mark entail, and exploit, a tension between different understandings of space. The trajectories of bodies and things that GPS traces refer to lend themselves to a relational conception of space, in which it is seen as secondary to the processes – that is, produced by the processes – that are normally thought of as occurring within it. In contrast, the gridded and mathematised framework within which those movements are plotted as traces works with – indeed, epitomises – an absolute conception of space.ⁱⁱⁱ For some writers, this tension between movement and the map is cast as a stark binary in which the gridded, absolute space of cartography is an alienating abstraction. This is a position influentially articulated by Michel de Certeau in the *Practice of Everyday Life* (1984); it is supported by Gilles Deleuze and Félix Guattari's critique of punctual lines in *A Thousand Plateaus*¹ and the work of contemporary Deleuzian theorists like Brian Massumi (Deleuze & Guattari, 2004 [1980], pp. 323-329; Massumi, 2002),² and it pervades the anthropologist Tim Ingold's work on lines and his critique of ways

¹ Gilles Deleuze and Félix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia* (London and New York: Continuum, 2004 [1980]), 323-29.

² Brian Massumi, *Parables for the Virtual: Movement, Affect, Sensation* (Durham, NC and London: Duke University Press, 2002).

of knowing the world that depend on a Cartesian dualism between mind and body, including western cartography (Ingold, 2000, 2007, 2011).³

“A Relic in Place of Performances”: De Certeau on the Mapped Trace of Movement

In *The Practice of Everyday Life*, Michel de Certeau describes the removal of narratives of travel and ornamental figuration from the map, as early modern cartography worked towards autonomy and the status of a science. He states that the map became “a totalizing stage on which elements of diverse origins are brought together to form the tableau of a “state” of geographical knowledge,” which obscures “the operations of which it is the result or the necessary condition” (1984, p. 121). This discussion forms part of de Certeau’s account of ‘spatial stories’, which he groups into two categories: tours (or itineraries) which narrate an embodied journey through a space and relate the position of features to that journey, and maps which offer a static, synoptic description of spatial relations. Although he uses maps as the paradigm for one pole of this binary, he describes a history of actual map-making characterised by mixed forms, but one in which the depiction of synchronic spatial arrangements came over time to efface temporalities: movement, practices, and narratives. Beyond any historic actualisation, however, the ‘map’ for de Certeau becomes an ideal type of one mode of spatial representation, which with its counterpart, the tour or itinerary, corresponds to the central binary that runs through the essays collected in *The Practice of Everyday Life*. This binary opposes ‘strategies’, ways of proceeding

³ Tim Ingold, *The Perception of the Environment: Essays in Livelihood, Dwelling and Skill* (London and New York: Routledge, 2000), ———, *Lines: A Brief History* (Abingdon: Routledge, 2007), ———, *Being Alive: Essays on Movement, Knowledge and Description* (Abingdon: Routledge, 2011).

based on knowledge of a pre-given, static spatial order, with 'tactics', ways of everyday coping which operate within this structure, providing the possibility of resistance.

De Certeau initially employs a graphic, synoptic metaphor for practices, drawing on a discussion of the trace-mapping of autistic children's movements by the French psychologist Fernand Deligny to introduce the idea of thinking of practices as spatiotemporal trajectories. However, almost as soon as he has introduced this idea he distances himself from it:

"Trajectory" suggests a movement, but it also involves a plane projection, a flattening out. It is a transcription. A graph (which the eye can master) is substituted for an operation; a line which can be reversed (i.e. read in both directions) does duty for an irreversible temporal series, a tracing for acts. (de Certeau, 1984, p. xviii)

This disdain for the trace of movement is most evident in the best-known section of *The Practice of Everyday Life*, the essay "Walking in the City." There De Certeau uses the strategies and tactics distinction to distinguish two types of vision, or perspectives. Strategies are associated with a projection and a view from above, the perspective of city planners and an explicitly cartographic gaze, "a picture, whose condition of possibility is an oblivion and a misunderstanding of practices" (de Certeau, 1984, pp. 92-93). De Certeau describes the kind of subjectivity personified by this view as that of a "voyeur-god ... who ... knows only cadavers." (1984, p. 93). Tactics, on the other hand, are associated with

an embodied, grounded perspective. Walking in the city happens below the threshold of strategic vision, evading it, writing in its margins; the pedestrian is celebrated as an active producer of an urban text. While romanticising the anonymous walkers of the city and their resistant marginalia, de Certeau argues that capturing their 'writing' in linear traces is redundant:

It is true that the operations of walking on can be traced on city maps in such a way as to transcribe their paths ... and trajectories. But these thick or thin curves only refer, like words, to the absence of what has passed by. ... They allow us to grasp only a relic set in the nowhen of a surface of projection. Itself visible, it has the effect of making invisible the operation that made it possible. These fixations constitute procedures for forgetting. The trace left behind is substituted for the practice. It exhibits the (voracious) property that the geographical system has of being able to transform action into legibility, but in doing so it causes a way of being in the world to be forgotten. (de Certeau, 1984, p. 97).

Mike Crang states that de Certeau is "cautious of representational knowledge, where practices are made to denote a shift in some system to an observer conceived as outside it" (2000, p. 146). For de Certeau practices, narratives, itineraries – that is to say, movements – are ultimately unrepresentable within a spatial projection. The mapped trace of movement is inadequate for its purpose: all it can give us is "a mark in place of acts, a relic in place of performances" (de Certeau, 1984, p. 35).^{iv}

De Certeau is routinely cited in discussions of artistic practice involving urban walking, mainly in terms of the binary of aerial and grounded perspectives outlined above and the potential for resistance offered by the latter. However, I am more concerned here with the fact that he provides an exemplary version of a particular attitude to space, time, and movement, bound up with a historical account of the development of modern mapmaking and a pessimism about the potential of a specific type of mark: the trace.

Representing space and time

Doreen Massey locates de Certeau in a tradition in western thought, one in which time is privileged as the dimension of dynamism and change and space is denigrated as the dimension of the inert, the fixed, stasis and synchrony: his binary terms strategy and tactics map onto space and time respectively (2005). Massey tracks this tradition since the late nineteenth century and the philosophy of Henri Bergson, but as W. J. T. Mitchell and Mark B. N. Hansen note, the tendency to set “the two dimensions against one another in an ideological hierarchy” can be seen even in antiquity; they state that “Plato thought space was simply the material world, while time was the habitation of the soul” (2010, p. 102). Massey is interested in the way in which the negative associations of space are underwritten by its association with representation, understood as the fixing of the flux of the world in concepts and inscriptions. This, she argues, is a consequence of equating representation to spatialisation. She describes how Bergson sought to recapture an authentic sense of time in terms of what he called ‘duration’, that is, time experienced as continuity and flow, as opposed to

the understanding of time as segmented, a series of identical instants measured – spatialised – through the regular sweep of a clock's hands. Clocks represent duration by carving it up and making it like space: extensive, empty and homogeneous. In a similar way, de Certeau equated representation with spatialisation through his analysis of writing, whereby the moving hand leaves inscriptions in the empty space of the page, forming a system of knowledge:

For de Certeau, the emergence of writing (as distinct from orality) and of modern scientific method involved precisely the obliteration of temporal dynamic, the creation of a blank space (*un espace propre*) both of the object of knowledge and as a place for inscription, and the act of writing (on that space). These three processes are intimately associated. Narratives, stories, trajectories are all suppressed in the emergence of science as the writing of the world. (Massey, 2005, p. 25).

The production of knowledge requires the fixing of traces of movement, and a subsequent forgetting of the practices that produced those traces. This forgetting is what occurs in western mapmaking when it effaces the practices that lie behind its representations. The association of representation with spatialisation is at the heart of de Certeau's antipathy toward the mapped trace.

Massey's project is to offer an alternative to this loaded and limiting binary of time and space. She describes them as interpenetrating rather than counterposed, with space conceived as relational rather than absolute, the sphere of a plurality of interweaving trajectories (Massey explicitly seeks to recover de Certeau's rejected term), and always under construction. For Massey,

the importance of this teeming, unfinished concept of space is political. The understanding of space as produced by the ongoing interrelations between entities and identities – some of which will be social in the straightforward sense, that is, relations between human beings – fits with an anti-essentialist politics of identity, for identities seen in this way are constructed through social relations. Imagining space as the sphere of a multiplicity of trajectories means that the recognition of difference is hardwired in, and universalising accounts or viewpoints are no longer possible. Lastly, with space – and not just time – imagined as always in process, the future is genuinely open.

Nevertheless, the liveliness that Massey seeks for space still finds its model in the temporalities of Bergson and de Certeau, and in a sense she can be thought of as trying to extend them, to correct their treatment of space:

In the arguments of Bergson and de Certeau ... the issue is formulated as though the lively world which is there to be represented (conceptualised/written down) is only temporal. It certainly is temporal; but it is spatial too. And 'representation' is an attempt to capture both aspects of that world. (Massey, 2005, p. 27)^v

What is at stake then is not representations of space, but representations of space-time. As she states, "loose ends and ongoing stories are real challenges to cartography" (2005, p. 107).

Tim Ingold on Mapping and Movement.

What all of this adds up to is something of a problem, namely, that the theoretical resources that seem to offer the most vivid accounts of a relational spatiality in which movement is primary are characterised by their outright hostility to cartographic representation and technologies. One recent exponent of this anticartographic tradition is the anthropologist Tim Ingold. Ingold's project in the essays collected in *The Perception of the Environment* (2000) is to work through the dualisms that structure and divide his discipline and modern knowledge generally: nature and culture, biology and society, and underlying them, the model of Cartesian subjectivity that separates body from mind. The main strand of Ingold's discussion of maps in that book concerns the inadequacy of the concept of a 'cognitive map', that is, a complex internalised structure, as a model for human beings' knowledge of their local environment and wayfinding skills. Ingold develops instead a concept of environmental knowledge as a complex process, the ongoing formation of a matrix of mobilities, gleaned through experience or received through culture (2000, pp. 219-242). However, Ingold extends this discussion of cognition and embodied knowledge to actual, artefactual maps: he valorises what he calls 'mapping', which he equates to wayfinding, the active addition of new environmental knowledge to this matrix in the form of itineraries. Ingold's 'mapping' subsumes both map-making and map-use as traditionally divided by cartographic theorists, and it can (but doesn't necessarily) result in an artefact – i.e. a map – through a gestural re-inscription. However, these gestural re-inscriptions are not the gridded spaces of Euclidean geometry and synoptic vision of modern cartography. Ingold follows Michel de Certeau in arguing that maps produced in the Western cartographic tradition disguise the mobile operations that produce them.

Ingold's critique of cartography is developed further in *Lines: A Brief History* (2007), which relates a similar narrative of estrangement from authentic, embodied life with the onset of modernity, but here it is evidenced by – and enshrined in – the lines that our culture produces. In different forms and across a range of cultural contexts, Euclidean lines – what Ingold calls 'point to point connectors' – have superseded flowing, gestural lines. In cartography, for example, there is a fragmentation of the flow of movement as gestural traces of walking and its reinscription are broken, 'rolled up' into points and re-connected into assemblies.

Ingold develops his argument about movement through a linguistic analogy. *Ductus* is a term that refers to flow in speech and writing, particularly to the flow of medieval cursive script, both the way it was written and the way it was encountered during reading. *Ductus* returns at various points through Ingold's essays on different lines, and comes to stand as an emblem for a generalised concept of flow and movement that strongly suggests a kind of vitalism. Indeed Ingold draws on Henri Bergson's concept of *élan vital* to discuss the inadequacy of existing linear models for diagramming genealogy, and his concept of *ductus* and movement in the world as being properly un-representable by any line that breaks it into points is aligned with Bergsonian ideas of time as being properly un-apprehensible except as an unbroken continuity – what Bergson calls duration (2007, pp. 116-119).

In Ingold's more recent writing this concern with mapping and line continues, but now under the ontological figure of the 'meshwork' – a vision of the world as a tangle of animate matter, with each living thing a trajectory rather than a bounded entity (2011). The environment for Ingold is no longer a container-context, and is instead a web of relations within which organisms are entangled. These relations that comprise the meshwork are not connections between discrete entities, rather they are the trails "*along* which life is lived" (Ingold, 2011, p. 69 emphasis in the original). The texture of the lifeworld is therefore "a field not of interconnected points but interwoven lines" (Ingold, 2011, p. 70). Living organisms are not bounded, isolated things, rather they too are entanglements of lines of movement and growth. Life is linear.

Organisms and persons, then, are not so much nodes in a network as knots in a tissue of knots, whose constituent strands, as they become tied up with other strands, in other knots, comprise the meshwork. ... It is as their lines of movement, not as mobile, self-propelled entities, that beings are instantiated in the world.
(Ingold, 2011, pp. 70-71)

GPS as an artistic medium

GPS has been used as an artistic medium since the early 1990s: a small number of projects by a handful of practitioners appeared during that decade (Kurgan, 1994; Wilson, 2002), but there was a proliferation after the U.S. Government's suspended the purposeful degradation of the consumer GPS signal (a feature known as Selective Availability) in May 2000. Much of the work that has appeared since 2002 has been grouped under the locative media genre, a

category which emerges in the early to mid-2000s in the context of new media art mailing lists and events and refers to art projects involving mobile, context-aware devices and mapping technologies (Hemment, 2006; Tarkka, 2010; Tuters & Varnelis, 2006).

Many of these artworks take up Massey's challenge to deal with "loose ends and ongoing stories" (2005, p. 107), and one of the ways they do this is through their use of the mapped trace of movement. In de Certeau's terms, they reintroduce to the map the "itineraries that [are]... the condition of its possibility" (1984, p. 120). In participatory urban mappings like Esther Polak, Jeroen Kee and Waag Society's *Amsterdam RealTime* of 2002 we can see the movement of bodies – or alternatively, a city – visualised as a tangle of animate matter: a knot in the meshwork.^{vi} Although these artworks use the cartographic grid and its punctual lines there has generally been a "commitment to continuity", as Mark Hansen puts it (2005, p. 1207), evident in their handling of the GPS trace and their understanding of its referent. GPS is an unredeemably Cartesian technology for Ingold; however, this should not stop us from recognising that it is his understanding of movement that is at work in these artworks.

Ingold often articulates his ideas about movement and embodiment through textile metaphors, a link that is made material in Jen Hamilton and Jen Southern's use of sinuous thread and rope traces in their mapping installations, where the trajectories of bodies always exceed the flat coordinate system that wants to reduce them to a geometry of punctual lines. Hamilton and Southern's

Running Stitch, for example, was an installation and participatory mapping project that had four iterations in different cities between 2006 and 2009 (Figures 1 and 2).^{vii} In each iteration, the movements of participant walkers at large in the city were captured by GPS handsets linked to internet-enabled mobile phones, and the mapped traces of movement were projected in real time onto a fabric screen in a gallery. That screen was simultaneously used as a ground for embroidery by gallery-based participants; each stitcher was paired to a walker for the duration of their involvement with the artwork, fixing their traces in coloured thread.

Ingold's understanding of life-as-line is also evident in Daniel Belasco Rogers' autobiographical mapping practice.^{viii} Working across performance and visual art, Belasco Rogers uses his ongoing, diaristic mapping practice (*The Drawing of My Life*, 2003-ongoing) as a resource for autobiographic performances concerned with memory and mortality, and as a template for a wider personal data collection practice. Belasco Rogers' work accommodates the tension between a durational understanding of the virtual form of his life, and a developing understanding of the trace as the visualisation of digital data, in other words as a discontinuous, punctual line.

The Trace and the Inhabitable Map

My argument here is that these art practices are characterised by their exploitation of this tension between a relational conception of space associated with a particular understanding of movement and the absolute conception of space epitomised by cartography. In a series of essays published over the last

decade, Nigel Thrift has described the recent emergence of a relational sense of space – what he calls movement-space (2004) – that in fact depends fundamentally upon an absolute conception of space:

It must be noted that these sensings [of space as relational] would be impossible without the fine grid of calculation which enables them: they are not, as many writers would have it, in opposition to the grid of calculation but an outgrowth of the new capacities that it brings into existence. A carefully constructed absolute space begets this relative space. (Thrift, 2004, p. 98)

Similar positions can be found in actor-network theory work on new processual understanding of cartography (November et al., 2010), and Mark Hansen's idea that GPS is producing a practical understanding of time and space as imbricated – which he sees in terms of Bergson's duration (2005). In each instance, a relational conception of space in which movement is primary is seen as emerging due to, or facilitated by, the pervasive implementation of technologies that work with an absolute, gridded concept of space: GPS, cartography and the geospatial web. In these writings we can see an attempt to work with both conceptions of space without disengaging with technology.

To illustrate the conditions of life in movement-space, Thrift draws on Ingold's description of an authentic life of flow and movement imagined as a wandering line and lost – segmented – in the transformations of modernity. However, this is not a return: rather than recovering that way of life, Thrift

argues that “the kind of world in which this wandering, wayfaring line held sway is now being rebuilt, but out of fields of number, out of the stuff of calculable coordinates” (2011, p. 7).

From Belasco Rogers’ collaboration with his partner Sophia New, plan b, comes an image that I want to propose as an illustration of the teeming but gridded space that Thrift describes (Figure 3). It was originally produced for an article published in the journal *Performance Research* where the artists presented a series of maps on double page spreads, with Belasco Rogers’ movements mapped on the left hand page and Sophia New’s on the right: these maps were a record of all their journeys in Berlin for 2009, progressing from a city-wide view through successive levels of magnification, through their neighbourhood and street until finally depicting the few square metres of space directly outside the artists’ front door (Belasco Rogers & New, 2010). The artists state that “at this scale, the layered tracks become a complex abstraction. The street almost disappears, no longer readable as a map” (2010, p. 23). From a crazed web of traces, a partial grid can be seen emerging – an index, the artists believe, of the decimal degree of accuracy obtainable using their preferred (and dated) GPS receivers.^{ix}

plan b’s mapping practice is co-extensive with Belasco Rogers’ and New’s lives. In a discussion of the ‘lifeworks’ of the performance artist Tehching Hsieh, Adrian Heathfield (Heathfield & Hsieh, 2009) uses ‘durational’ in a way that conflates Bergson’s philosophical concept of ‘duration’ relating to the experience of time and ‘durational’ in the sense used in experimental theatre, relating to

generally task-based (rather than scripted) performances of unusual length. Heathfield states that “durational works may often manifest, prompt or even integrate a discourse on those necessarily failed forms of thought, memory, knowledge and representation that attempt duration’s resolution, stilling or fixing” (Heathfield & Hsieh, 2009, p. 22), and this includes the mapped trace of movement. Looking at plan b’s map (for in all of its abstraction it remains one), we have some choices. We can see the lines in terms of the ‘necessarily failed’ depiction of the continuous form of a moving body – as a reflection on the very necessity of that failure. Or we can see it in terms of the emerging grid, as if through a kind of frottage an alienating architecture was being revealed. However both of these readings rely on an opposition between life as an ineffable continuity and the technologies that mediate space and time, an opposition that Bruno Latour (with Bergson in mind) has characterised as “vain” (1997, p. 183). What I want to suggest is that we can instead see it in terms of the performance of gridding, as the record of acts of spacing and timing and testimony to their interpenetration, in Massey’s terms: as Adrian Mackenzie states, “as a positioning system based on atomic clocks, GPS confirms the inseparability of timing and spacing” (2002, p. 108). These are acts that involve a vast assemblage (bigger than the planet itself) of human beings and technical elements, all of which are moving parts. All of the lines on plan b’s map, even the orthogonal ones, are the traces of movement – however imperfectly captured.

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Image captions

Figure 1. Jen Hamilton and Jen Southern (2006) *Running Stitch*. Installation and participatory mapping project. Detail of screen, showing projected traces (top left) and stitching.

Figure 2. Jen Hamilton and Jen Southern (2006) *Running Stitch*. Installation and participatory mapping project. Detail of screen, showing participant stitching.

Figure 3. Daniel Belasco Rogers (2011). The street immediately outside Belasco Rogers' front door, showing Belasco Rogers' traces for the period 2007-2011 reproduced at a very large scale. Produced by the artist on request for the author, this image is an updated version of those on the last double page spread of 'Me, You and Everywhere We Go,' *Performance Research*, 15:4.

ⁱ Others include Russia's GLONAST, the European Union and European Space Agency's Galileo, and the Chinese BeiDou systems.

ⁱⁱ <http://www.openstreetmap.org/>

ⁱⁱⁱ For a terse and effective account of the distinctions between the absolute, relative and relational conceptions of space, see David Harvey's essay "Space as a Key Word." (Harvey, 2006).

^{iv} I should add that although I am characterising de Certeau as anti-cartographic – a fair reading, based on *The Practice of Everyday Life* – he did also write elegantly and affirmatively about maps in a catalogue essay for the environmental artists Helen Mayer Harrison and Newton Harrison, likening their cartographic studies to the transitional stage between medieval and modern representations of space during the age of discovery, when the map was still home to "visionary follies", combining "the passion of seeing and the passion of creation," (de Certeau, 1985, p. 17).

^v Massey sees Bergson's later work (particularly *Creative Evolution*) as pointing to a more considered conception of space, particularly in his recognition of duration in external things (that is, outside the subjective apprehension of time). She also states that she is seeking a "fault line in de Certeau's argument [about time and space] which enables it to be levered open and developed": (Massey, 2005, p. 46).

^{vi} <http://realtime.waag.org/>

^{vii} <http://www.satellitebureau.net/p8.php>

^{viii} <http://www.planbperformance.net/>

^{ix} Daniel Belasco Rogers in conversation with the author, 28 December 2010.