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RESEARCH ARTICLE

Digital mapping as double-tap: cartographic modes, calculations and failures

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In this article, we will ask how Latour's latest project – *An Inquiry into Modes of Existence (AIME)* – can help us to understand the nature of cartographic modes, calculations and failures. To this end, we will argue that in his many readings, specifically *digital* mapping can be said to operate through a 'double-click' mode which obscures the [REF–REP] crossing of which he now speaks of in *AIME*. More appropriately, we refine Latour's argument to suggest that contemporary navigational practice involves not simply a 'double-click' mentality but a 'double-tap' one. This action enables the user to not only zoom into the mapping interface – by virtue of a double-tap of a touch-sensitive screen – but also manipulate phenomena in mobile and haptic terms, as if the world was both accessible and knowable through the fingertips. This small tweak in terminology strengthens Latour's account of prevailing modern thinking, to allow for an even more robust analysis to take place. However, Latour is not the first to think in terms of 'modes'. Critical cartographers, for instance, have talked of so-called 'mapping modes'. Latour's ontological pluralism, together with these other cartographic and methodological versions, can help us to identify different operative elements in various digital mapping enterprises. We further argue that there is still considerable value in employing Latour's long-theorized notions of immutable mobility, inscription and calculation, so long as they are updated and refined for contemporary practices, and the various bridging strategies mentioned above are implemented and taken into consideration. In returning to our initial point, we then argue that there are moments in which this double-tap philosophy is laid bare and the seamless linking of the [REF] and [REP] modes of existence unravel. Taking on and extending Latour's interest in 'failure', we argue that the best way to challenge double-tap thinking, in a methodological sense, is to focus on the nuanced nature of digital mapping failures since these are instances that mapping no longer works 'without a hitch'. In such moments, the aura of unmediated technological practice slips. Instead, the bare operational bones are exposed, allowing the user to gain access to its failed state. We substantiate this final argument with reference to two cartographic cases concerning a flood event and a series of protest demonstrations.

Keywords: digital mapping; immutable mobility; modes of existence; double-tap; failure; mapping modes; AIME

Introduction

The world at your fingertips

> *With 'ifs' we could put Paris in a bottle, goes the saying in French; with maps we put it in even faster!*
>
> Latour and Hermant (2006, no p.n.)

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Cartography has provided Latour with the clearest and most constant illustration of the false propagation of a catalogue of Cartesian divides. He has frequently returned to a series of very particular kinds of mapping stories, notably those involving imperial cartographic projects, urban technological innovations and European mountain hiking to prove his point. In an early article, Latour (1986) detailed La Pérouse's contact with the inhabitants of Sakhalin to discuss the concept of immutable mobility. In *Aramis* (1996), his ethnographic work drew attention to the calculative futures envisaged in the development of rapid-transit networks, whilst most recently in *An Inquiry into Modes of Existence* (2013) – henceforth *AIME* – he uses the map–territory debate to further clarify his use of immutable mobility and 'chains of references' as terms with which to interrogate modern thinking and the crossing between different types of ontologies.

It is through an earlier online project (Latour and Hermant 2006) predating *AIME* that Latour first introduces his double-click philosophy.[1] With the help of various navigational narratives of École des Mines administrators, French Satellite Pour l'Observation de la Terre (SPOT) satellite operators and Parisian road maintenance teams, Latour argues that mediation is unavoidable and makes several claims related to that. First, that direct access to the world and its phenomena is impossible – a refrain seen throughout his work on Actor-network theory (ANT) and beyond. Instead, observations are routed through various technologies such as the organization charts, false-colour satellite imagery and humble road signs. Second, that this relationship between object and world, or alternatively map and territory, is necessarily co-constitutive. In other words, the dichotomy between map and territory is a false one; both maps and territories are co-constructed in relation to one another and are outcomes of translations. The map does not lie outside of the territory, and neither can the territory ignore the power of the map. The map animates the mediated relationship between technologies and worlds.

In *AIME*, Latour refines his understanding of the Double Click [DC] character further. This 'Evil Genius' (Latour 2013, 93) does not believe that there is an ongoing series of translations in every encounter – as ANT originally suggests – but judges it to be wholly possible to access things and knowledge directly, freely and unequivocally; like in the perceived operation of a computer mouse. In this, DC steadfastly holds to the purity of knowledge creation – a conceit endlessly offered up by the Moderns. This is what Latour (2013, 127) calls 'straight talk'. Once this supposition is made – of information without transformation – it calls into doubt all other 14 modes of existence identified by Latour. Each of these modes exhibits their own operational characteristics different from those governing DC. The famous 'network' of ANT is relegated to one of these as [NET]. Rather than privileging any one mode, Latour is now keen to investigate these many 'truth regimes' (Tresch 2013, 303) on a more equal level. However, it is DC to which all other modes are opposed.

Digital mapping is arguably Latour's finest example of this so-called 'anti-mode' (Norton 2013, 3). It is the most aggressive perpetrator of double-click thinking, epitomized by the current claim by Google Earth that it is possible, courtesy of its now ubiquitous digital platform, to '[g]et the world's geographic information at your fingertips' (Google 2014). Thus, Google Earth brings the world into a particular kind of 'alluring', 'seductive' and 'intoxicating' view (Kingsbury and Jones 2009, 505), permitting a very peculiar kind of seemingly placeless observation, gifting the user an 'omniscient optic' (Brannon 2013, 278) above the ground. It is what Pickles (2003, 80) calls the 'cartographic gaze' and Haraway (1988), famously, the 'god-trick'.

However, as we argue, with the proliferation of touch screen interfaces, users of new digital mapping platforms engage not in a double-click manner, but in a *double-tap* action.

In order for users to zoom into a mapping interface of any touch screen device, they have to perform a double-tap of the desired area. Completing the command will see the map focus. In so doing, as Google Earth claims above, it becomes even more intimately possible to access the world's geographic information through one's fingertips. Furthermore, as these touch screen capabilities are more prevalent in mobile devices such as smartphones and tablets, double-tap also refers to actions 'on-the-go' in which navigational knowledge is sought through the touch of these digital interfaces.

The 'technologies of vision' that Pickles (2003, 81) identifies as being so central to the cartographic gaze become, far more radically, technologies of touch. Doing away with the double-click of the computer mouse, therefore, invites an even more intimate discourse of unmediated access where crossings between different modes of existences become indiscernible. The sheer multitude of actions required to bring any one digital map into being is rarely exposed (aside from through the failures we discuss later), with the technological transformations required to render such images as natural and normal calibrations black-boxed and hidden from the view itself. Latour's depiction of this anti-mode, then, is one routed in a digitally navigable sensibility.

In this, we are able to refine Latour's own depiction of his DC character. Whilst the double-click of the computer mouse takes us from one page, document or website to another – in so doing solidifying the perception of immediacy – the double-tap of a digital map through a touch screen interface is purported to allow us to 'access', interrogate and manipulate the world itself. Latour's repeated cartographic stories, although vivid illustrations of this claim to immediacy, remain inattentive to these technological developments, that, in actuality, strengthen rather than weaken Latour's thesis of the Moderns.

Ontological, cartographic and methodological modes

> *...[E]ach mode requires us to encounter distinct beings that must be addressed in their own languages*.
>
> Latour (2013, 288)

> *Each cartographic mode gives rise to its own kind of map artifacts...*
>
> Dodge, Perkins, and Kitchin (2009, 221)

Latour's desire in *AIME* is to tease apart the multiple, and often competing, possible truth regimes in the modern world. By his own admission, his previous investigations have failed to capture the pluralistic nature of such. In his theorization of networks [NET], he has admitted to a failure to attend to 'differences' (Tresch 2013, 306), despite an ability to draw attention to 'connections', as ANT is famed for. Such 'value conflicts' (Latour 2013, 17) have been central, it is now argued, to how knowledge is not only constructed but also critiqued by the Moderns. The form of these critiques often does not arise from within such value frames, but arise from outside their boundaries (economic perspectives on science, religious views on law etc.), with 'the veracity of one mode' being 'judged in terms of the conditions of veridiction of a different mode' (17–18). In this, the analytical waters have been muddied, with the lives of the very actors under study left untouched.

As such, Latour insists that each mode must be considered on its own terms. But as he is keen to stress, this is not simply a battle of language; between how economists 'present' their calculations, how the clergy 'preach' their doctrine or how each interpret the other's world. According to such a principle, practitioners would engage simply in a series of 'language games' (Latour 2013, 20), and as such:

> Being would continue to be expressed in a single, unique way, or at least it would continue to be interrogated according to a single mode – or, to use the technical term, according to a single category. Whatever anyone might do, there would still be only one mode of existence – even if 'manners of speaking' – which are not very costly, from the standpoint of ordinary good sense – were allowed to proliferate. (20)

Namely, it would be a question of who could speak most eloquently of this one world – this one mode – rather than who could produce the most resilient forms or the most adaptable worlds. As Latour is still a devout semiotic-materialist, this argument extends through speech acts and into the messy object-ness of the world. Thus, instead of being an argument on the plural nature of language across a single world, Latour is claiming the existence of multiple kinds of inscriptive powers and mechanisms for articulating concerns and expressing beliefs. The benefit of such is that it now becomes possible to compare and contrast alternative modern modes. This is Latour's *ontological pluralism*.

In a cartographic context, Matthew Edney (1993) has also employed a kind of modal framework to demand a non-linear, non-teleological view of mapping history. Distinguishable from Latour's more radical ontological claim, Edney's *cartographic pluralism* is an arguably less contentious attempt to combat mapmaking's perceived objectivity and neutrality. In doing so, he argues that:

> Cartography is composed of a number of *modes*, or sets of cultural, social, and technological relations which define cartographic practices and which determine the character of cartographic information. (Emphasis authors' own)

For Edney (1993, 54), cartography is 'generally conceived' as a 'singular and monolithic enterprise' in which 'empiricist claims' about the world as distanced, discoverable, observable and knowable are furthered. This is the kind of techno-scientific understanding of the world that Latour has previously spent much of his time investigating, principally in *We Have Never Been Modern* (1993), and it is also a vision of the world which the likes of Pickles (2000, 2003) and Cosgrove (2001, 2008) have been at pains to document. However, in offering his idea of cartographic modes, Edney attempts to avoid a 'Whiggish history'[2] of mapmaking that takes into account the very many ways in which cartographic practice has been constituted.

But Edney's modal framework is rather more modest and less radical than the one Latour outlines more recently in *AIME*. Nowhere, for instance, does Edney suggest that there are multiple existential states through which cartography is composed. There is no discussion, either, of how these various truth regimes impose their ontological order on actors and things, i.e. through particular instruments or mechanisms. Crucially, nor is there a desire for Edney to test the veracity of any one cartographic mode on its own conditions of veridiction, as demanded by Latour in *AIME*. Instead, Edney simply desires to oppose a reading of cartographic history as an empiricist one. This in itself though is remarkably similar to Latour's denunciation of double-click thinking – both of which are dependent on unmediated access to the world – except Edney does not use his critique as a basis for a much grander argument concerning ontological pluralism. However, as we will show in more detail in the cases discussed below, Edney's modal framework is very much complementary to Latour's, with the former's being able to guide the search for the latter's.

In a similar context, Dodge, Perkins, and Kitchin (2009) build on Edney's modal framework to develop a kind of *methodological pluralism*. In this, they identify five possible sites for future mapping research: interfaces, algorithms, cultures, authorships and infrastructures that extend the emphasis beyond the map-as-object. In each, they are

keen to emphasize new developments in the world that change the nature of cartographic research. This is not, however, entirely the same as Edney's working notion of cartographic modes as they are more concerned with methodologically situating mapping as particular kinds of knowledge productions. Dodge, Perkins and Kitchin do not desire to specify any spaces or places that might yield new insights into contemporary cartographic practice as Edney does. Moreover, their concern is not the prevalence of a Whiggish, empiricist history of cartography that denies the contingency and plurality of various mapping modes, but the dearth of research that pays attention to new sites, devices and artefacts arising since Edney's contribution.

Thus, they demand an evolution in map studies that brings into play a whole wealth of new situated, methodological approaches. Touch screen interfaces, for example, have proliferated over the last 10 years and are now incorporated into a range of mobile, lightweight and multifunctional devices unimaginable in the early 1990s. Paying attention to this site, as Dodge, Perkins, and Kitchin (2009, 222) argue, would allow an interrogation of the interface's ontological status as technological, visual artifact designed to both 'en-frame and exclude' as well as its attendant effects (Galloway 2012; Hookway 2014). Employing their plural methodological framework, in concert with both Latour's and Edney's, thus strengthens the search for any one of the *AIME* truth regimes; not least supporting the subtle terminological transition from double-click to double-tap introduced earlier.

As we have already suggested, and will further argue, Latour's schema can be considerably strengthened with these accompaniments. We now intend to work with three types of pluralism: ontological, cartographic and methodological. In doing so, we are much better placed to attend to the ways in which digital mapping worlds are composed.

Plurality of digital worlds

What cartographic objects are mobilized to verify these digital mapping worlds? Each assemblage has its own specific instruments for knowledge production – its own inscriptions, calculations, risks, mobilities and immutabilities. Ensuring that we properly account for these various cartographic modes is critical. However, as Latour is keen to stress, these are not language games but those concerning ontological realities. The rigorous deployment of these modes results in a varying array of material connections being made. In cartographic terms, these are relationships forged between technologies, map users, satellite companies and spatial forms.

AIME allows us to consider the plurality of these digital worlds by attending to the specific kinds of calculations required to advance cartographic arguments within and across particular modes. But in order to do so, we have to mobilize a number of Latourian concepts that allow us to identify these cartographic instruments. Most important of these are (im)mutable mobility, inscription and calculation. Together, they allow us to trace an understanding of maps and mapping practices as inherently situated deployments. As part of our understanding of the world as replete with varying modes of existence, we need to reserve judgment on a number of issues. For example, as to whether, as Latour (1986) has previously said, maps are immutable mobiles. In keeping with his modal analysis, and in concert with Edney's (1993) and Dodge, Perkins, and Kitchin's (2009) own theorizations, we need to understand how various domain influences *amplify* and *modulate* certain factors, such as the mutability of a map. In doing so, we remain attentive to both the fluid nature and the plurality of cartographic deployment.

Immutable mobility

The notion of the map as an immutable mobile can be traced back throughout Latour's work (see Latour 1986, 1987; Latour and Hermant 2006; November, Camacho-Hübner, and Latour 2010), appearing also in the third chapter of *AIME* (Latour 2013, 69–93), when another cartographic tale is told. Introduced as a meaningful anecdote to come to a better understanding of techno-scientific artefacts in general, it has been picked up by scholars working on cartography as a means to better understand mapping practices as techno-scientific processes. Kitchin, Perkins, and Dodge (2009), Vertesi (2008), Bolt (2004) and Bier (2014) have all variously returned to these stories to exemplify the nature of inscription to argue that maps possess a performative dimension. Whether digital maps *continue* to operate as immutable mobiles too, however, is now contested (Lammes, forthcoming; Perkins 2014).

Already in an early article, Latour (1986) used a mapping practice as an example to argue that *a priori* divisions such as those between scientific and pre-scientific knowledges only result in what he later calls 'language games' (Latour 2013, 20). Understanding the generation of these divisions should be a more pressing pursuit, as he maintains in *AIME*. Maps, as well as 'diagrams, blots, bands, columns', are things 'which have the properties of being *mobile* but also *immutable, presentable, readable* and *combinable* with one another' (Latour 1986, 7, emphasis authors' own). Activities as wide-ranging as seafaring and mountain-climbing are transformed into map inscriptions. With these transformations, certain references are filtered out and others are preferred, leading to a map as a narrowed down framework.

In this, Latour (1986, 10) emphasizes the role of craftsmanship in producing 'optical consistency'. In his reading of Svetlana Alper's (1983) *The Art of Describing*, he notes how methods of instrumentation change what she calls 'visual culture'. It is these calculative techniques, in combination with the 'simultaneous transformation of science, art, theory of vision, organization of crafts and economic powers' (Latour 1986, 9) that actively produce new ways of not only seeing, but more importantly, navigating. In *AIME*, he also adds that whilst inscriptions are plural and contingent and can be situated in and across different modes of existence, those such as habit [HAB] – 'the patron saint of laid-out routes, pathways, and trails' (Latour 2013, 265) – remove the endless effort of correspondence one is often forced to make when taking unknown steps. It is the map that solidifies this [HAB–REF] crossing. As in the early Latour, there is still a continued focus on transformations and discontinuities that alter the way we think and act. Technological inventions, he argues, have this transforming potency when they gather a large number of 'well aligned and faithful' allies.

Latour's (1986, 9) story of La Pérouse shows how such 'simultaneous transformations' are set in motion. In it he describes the actions of the French explorer – La Pérouse – upon reaching the island of Sakhalin, whose outline at that time was somewhat unknown to Western explorers. As in many colonial expeditions, it was La Pérouse's aim to bring back irrefutable knowledge on the far-reaches of the globe. As part of this mission, it was necessary to draw a series of maps in order to convince French officials as to the veracity and potentials of their discoveries. According to Latour's narrative, the only, but critical, difference between the French explorer and the Sakhalin natives is that the former intended to bring his cartographic inscriptions back to France where he would be able to gather and mobilize allies (monarchs, scientists, the public) to make his map immutable and mobile. The native sand maps, on the other hand, are both mutable and immobile. By becoming an immutable mobile, the map of La Pérouse has a particular

transformative power: it will allow others to travel the Pacific, thus strengthening the position of the French Empire. This map is the result of a process, a specific mission during which La Pérouse has to use his (and others) craftsmanship to transform stories, pencil drawings, local testaments, log books etc. into a cartographic inscription, rendered in his notebook, reproducible and re-combinable, and therefore presentable and readable to others who endeavoured to make the heretofore unprecedented journey through the bottleneck of the Nevelskoy Strait, as it is now known.

In *AIME*, Latour once more turns to the map to explain immutable mobiles as 'technologies of visualisation and inscription' (Latour 2013, 77). Now he relates this to two particular modes of existence: reference [REF] and reproduction [REP]. [REF] is the mode of existence that focuses on the *chains of production* that are encapsulated by immutable mobiles. [REP] explains not knowledge itself, but how knowledge is produced in trajectories of continuity. The [REF–REP] crossing is a trajectory that needs disentangling according to Latour. And it is exactly this passage that is being obscured in the double-tap mode that digital mapping entices us to take on, resulting in a confusion of 'the territory with the map, the equipment of a road with the cliff that it makes accessible' (Latour 2013, 87).

As he rightly observes, this anti-mode is even more prevalent in mapping practices as the correspondences between map and territories are historically rooted in so many intertwined chains of production. In the case of maps, [REF] can be understood as being part of a historically situated and discontinuous chain of production 'from the timid origins of Greek geometry, up to its impressive extension today' (Latour 2013, 77). It is these 'chains of production' that draw us to the mapping interface itself, which, as effortlessly as possible, invites us to seek and find correspondences between itself and the territory we traverse. So much so that it suffices for Latour to say that 'once everything is working without a hitch, we can say about correspondence what we would say about natural-gas, or WiFi: "Reference on every floor"'. (77) That is, the map doesn't mimic or cover the territory as a 'thing known'. On the contrary, it is because of a 'loss of resemblance' between map and territory (78) that [REF] can propagate itself as mode of existence to know distant things.

So Latour understands maps as prime examples of immutable mobiles: they can be carried around and shared whilst their shape remains stable. Layers can be added in the forms of notes, or specific details (superimposition) and the whole document or image can be reproduced through printing or copying. This is why Kitchin, Gleeson, and Dodge (2012, 2) suggest that 'mapping practices give mappings the semblance of being "immutable mobiles" with ontological security' as their use is 'learned and constantly reaffirmed'.

However, the ontological security of digital maps is now in question. As Perkins (2014) and Lammes (forthcoming) have argued, digital map *images* are markedly more mutable than analogue versions. A particular new breed of digital map has a degree of contingency worked into its design and application. Many of these maps, therefore, cannot be said to necessarily be 'immutable'. Perkins (2014, 304), for example, suggests that crowdsourced mapping platforms such as OpenStreetMap (OSM) are 'likely to comprise a hybrid of mutable and immutable elements' rather than either a concrete set of unchangeable components or an endless array of mutable ones. Thus, we cannot strictly suppose that digital maps have any universal im/mutability.

The network that makes this image possible nevertheless still consists of a raft of ongoing connections between technologies that are all highly predetermined and immutable – from cell tower infrastructures to circuit chips. This network is in itself very much

ontologically secure, functioning through principles of reproduction, inscription, superimposition and scale. The map image may be continuously remade, but this is facilitated by a highly mobile and sophisticated network in which many immutable things circulate facilitating new connections that lead to that image. Thus, talking loosely of the im/mutability of the digital map, without deploying the schema in *AIME* alongside Edney's (1993) and Dodge, Perkins, and Kitchin's (2009) modal thinking propagates not only a kind of narrow relativism in which maps are 'either' immutable 'or' mutable mobiles, but also a teleology in which all digital maps are presumed to be mutable (read: more useful, 'innovative', responsive and flexibly designed) and all non-digital maps immutable (read: 'backwards', easily out-of-date, inaccurate). Instead, the various kinds of inscriptive tactics and calculations made through each cartographic mode generate new possible states and elements, new contingencies and opportunities.

To paraphrase Latour's (2013, 74–88) hike up the mountain, with a double-tap, we set a composite network in motion formed by the paths, maps, weather forecasts, GPS-enabled devices, hiking equipment, satellites, map grids, automated device reports, phone signals, battery life and so forth. It is even a more complex and costly network of immutable mobiles than in pre-computer times, one 'that sums up, brings together, draws aside, and compresses hundreds of person-years and some of the most innovative, audacious, stubborn, and also costly human endeavors' (Latour 2013, 79). Through a double-tap, we set new assemblages in motion while their and our mobility and velocity makes it even harder to disentangle the [REF–REP] crossing.

Calculative transformation

The development of the notion of 'centres of calculation' (Latour 1986, 29) and the continued emphasis on 'transformations' throughout *AIME* (in chapters 7 and 8, for example) is central to the map's deployment and its enrolment within a suite of supportive alignments. In a geographic context, Crampton (2011, 92) suggests an 'overlap' of this with his own offering of 'cartographic calculations of territory'. This connection between the two – centres of calculation and cartographic calculations of territory – although not entirely developed by Crampton (2011), does provide for some analytical possibility. Whilst the digital map, for instance, is not itself *both* a centre of calculation *and* the primary node through which calculations of territory are made, it is, however, the *product* of centres of calculation and the *generator* of cartographic calculations of territory. A combination of both of these calculative concepts points to the more general argument concerning the socio-technical shift from apparatuses of control (Baudry 1976; Foucault 1980) to more Deleuzian 'networks of control' (Galloway 2012) in which power is distributed more dynamically through these various centres of calculation and through which maps circulate (Lammes, forthcoming).

Not only is the networked process that leads to the digital map far more dependent on fast, and multi-directional calculations, these processes are also, arguably, far more foregrounded. Being invited to give input that leads to the map image (e.g. velocity, movement, postcode entry, traffic warnings), users have more of a chance to participate in the chains of production that lead to the mapping image. This is exactly the point that November, Camacho-Hübner, and Latour (2010) wish to make, suggesting that digital mapping practices should be conceived more as 'navigational' endeavours rather than mimetic ones, because they foreground the processual quality of mapping and show the chains of references that have called them into being.

When we go back to La Pérouse's journey, we see a cartographic outcome that has prioritized certain references over others in order to serve a specific, socio-political purpose. The stories of the locals are now absent, as are the instruments, walks and treacherous patches while navigating the seas. These messy parts of the process have been erased and what we are left with is a map as a 'frozen image' (November, Camacho-Hübner, and Latour 2010, 583), which may 'unfold' (Kitchin, Gleeson, and Dodge 2013, 1) differently for various users, but which presents itself as a mimetic interface that prefers certain references over others and functions by the grace of the absence of traces of production. Such images are but small elements of a much grander 'navigational platform' (November, Camacho-Hübner, and Latour 2010, 584).

For November, Camacho-Hübner, and Latour (2010), a difference between Before Computer (BC) and After Computer (AC) maps can be neatly made. Whilst the navigational processes at work in an AC era are not necessarily new, such transformations are now more detectable to ordinary users: 'digital techniques have rematerialized the whole chains of production' (584). Hinting at a specific definition of maps as immutable mobiles, the authors define *all* maps as featuring steps of data 'acquisition', 'management' and 'calculation' (584) and as being used for navigational purposes. Yet because all these steps that make up a map are now accelerated and because there are more 'feedback loops' (584) between these steps, end users become more aware of them.

With this shift in perception, so the authors claim, users can also become aware of the fact that the 'correspondence' (Latour 2013, 71) between the map and the territory is the result of a practice of filtering that the story of La Pérouse alludes to. According to the authors, they become navigators instead of readers of mimetic inscriptions, looking for significant signals to move to new signposts. These signposts are not so much perceived as bearing a direct resemblance between territory and map, but more as having relevance for navigating through an environment with a specific goal. The latter is what the authors mark as a navigational meaning of maps that users of digital mapping interfaces actively engage with.

Although we agree with November, Camacho-Hübner, and Latour (2010) that digital maps are more navigational than mimetic, the prevalence of the double-tap mechanism does not invite users to become more *critically* involved in processes of data calculations, circulating immutable mobiles, messy moments and so forth. In fact, it wilfully obscures them. As we stated before, we should attend to differences in mapping modes, and some (if not most) digital maps do not invite us to reflect on such chains of production at all, but make us believe that everything is reachable, calculable, approachable and at one's fingertips. In particular, it is the mobile maps used on touch screen devices that lead us to believe in the seamless experience of physical movement and navigation; adhering very much to the double-tap philosophy. Enterprises like Google Maps want users to believe that the interface (as intermediary) has become so transparent that landscape and map can be perceived as interchangeable and even collapsible to the extent that the question of correspondence virtually and practically seems to evaporate. The double-tap mode inhibits us from following any traces that can make us understand [REF] and [REP] as well as their crossings because it promises an even smoother correspondence between map and territory.[3] As we will show in more detail later in this article, it is only when this network set-up breaks down that modes of existence and their crossings can be unravelled and critically examined.

In *AIME*, Latour (2013, 74–92) recounts a story of climbing a mountain. Although his references are to a specific topographic paper map, he unproblematically extends the narrative to a GPS device. However, he does not appropriately tailor his immutable mobile motif. Arguably, it would have produced an even a greater impression of

alignment and continuity of the trails, his footsteps, the weather and so forth. Precisely, because this digital map would be a navigational interface inviting the user to set in motion complicated processes of calculation through a double-tap on the screen, it would have been very difficult for him to trace the chains of production that constantly feed back. Hence, facilitated by a denser network, Latour may have experienced a far 'smoother' alignment of experiences than with his paper map. The result? An even greater degree of perceived immediacy and intimacy with the mapped phenomena.

Failure as mapping methodology

In their recent manifesto, Dodge, Perkins and Kitchin, alongside calling for what, in our terms, amounts to a methodological pluralism, argue for a greater focus on 'moments of mapping failure' (2009, 234). As they suggest, many of these moments occur when software fails. Think in particular of the Apple Maps controversy in 2012.[4] One of the criticisms recently put forward by Bittner, Glasze, and Turk (2013) is that, in attending to the 'successful establishment of relationships' (no p.n.), ANT fails to trace these failures. It is, they suggest, geared towards an investigation of the victories. The 'black-boxing' of technological infrastructures does not routinely allow for analytical intervention, but when failures in such architectures occur, the workings of these technologies are exposed. Moreover, these rare but not entirely infrequent occurrences provide us with ample opportunity in which to investigate the [REF–REP] crossing identified in *AIME*.

In an expressly cartographic frame, Latour has been markedly more interested in the successes of colonial mapping infrastructures such as 'marine clocks, quadrants, sextants…[and] preprinted log books…' (1987, 224). Ultimately, Latour is most attentive to successful scientific practice. Only *Aramis* (1996) has dealt expressly with the failure of a technological project, only briefly touching on its navigational possibilities. Edney (1997), Burnett (2000), Akerman (2009) and Driver (2001), however, have drawn notable attention to the failure of many modern imperial mapping endeavours. Edney (1997), for example, charts the geographical construction of British India across the eighteenth and nineteenth centuries, arguing that the surveys carried out in order to map the whole empires, although 'simple in concept', were wickedly difficult to perform, requiring the aligning of many different objects:

> A triangulation is slow. Even the simplest triangulation requires a great deal of planning to identify hills and buildings to be used as stations. On occasions, towers must be built. Flags and poles have to be erected on hills to provide unambiguous targets for the surveyor; even then, such targets can be obscured by clouds, rain, or heat haze so that the survey's progress is unpredictable. Once the numerous observations have been completed, there are even more complex calculations to be computed. A triangulation is costly. The instruments for measuring horizontal angles (theodolites) are expensive. (Edney 1997, 26)

These are classically ANT concerns regarding technologies (theodolites), inscriptions (surveys), experts (surveyors) and calculations (triangulation). Yet, their precariousness is a notable omission in Latour's work, presented as they are as totalizing missions – further evidence of the perceived continuity of these modern mapping endeavours. Even when the subject matter is broached by others (Law 1986), again, the emphasis is on success. Attending to the way in which mapping practices come to fail is an important focus in the light of Latour's new pluralistic commitments, as they reveal something of the working of each particular mode – as well as their attendant crossings – when failure hits.

In a non-cartographic context, Allison Hui (2012) has taken issue with the notion of immutable mobility, bound up as it is with the investigation of successful knowledge formation and object creation. In order for things to become immutably mobile, they have to be operationally sound, and thus transportable. This is [REF – REP] in action. She argues that this conception hinders an analysis of what she calls 'mobile practice networks'. These activities, such as patchwork quilting and birdwatching, are designed to be carried out on the go and, as part of this, involve 'temporary accomplishments' (Hui 2012, 195). As such, they do not subscribe to the notion of immutability, valuing the flexibility and re-combinability of equipment within these networks. Under Latour's focus, things are valourized for their black-boxed nature – as packaged and processed as unchanging technologies. For patchwork quilters, there is, however, no desire to 'bring things home' in Latour's words and to 'act at a distance' but to remain on the move whilst 'act[ing] in the presence of another location' (207). Unlike the colonial maps in Latour's story of La Pérouse, these mobile practice networks are defined by 'intermittent accomplishments' (206).

Yet whilst Hui (2012) allows us to move beyond the immutable mobile, there is still an explicit emphasis on the success of both inscription and mobility (albeit without a return to a 'centre' as such) that strengthens a victory-based narrative.[5] In so doing, Hui (2012) inadvertently props up Latour's consistent thesis on the nature of mapping endeavours. In the ensuing analysis, we draw attention to how persistent and enduring *failures* challenge the perceived continuity of the [REF–REP] crossing.

Fluid events

An illustrative case charting the importance of failure can be found in a recent UK flood event. With much of the county of Somerset underwater in early 2014 thanks to persistent, heavy rainfall, the Environment Agency (EA) – the non-departmental public body responsible for dealing with environmental issues – generated a map through the 'International Charter Space and Major Disasters' mechanism to visualize the extent of the flooding and aid organizational efforts in the local area. The charter was 'activated' on 6 January 2014, with the map itself generated from SPOT 5 satellite data collected at 10.51 (UTC) on 11 January 2014. In the ensuing weeks, it assumed prominence in most online media coverage of the event.

Conveniently, Latour and Hermant (2006) have focused on one of the actors involved in the processing of satellite images that compose such maps, to illustrate what Latour calls in *AIME* the [REF] mode. In acquiring their own data on Paris, they suggest that

> … in its regular ninety-minute orbit, [the satellite] sees nothing at all. It passes by, slides past, collects, processes, formats, encodes, transmits. The *SPOT* operators in the blind control room in Toulouse who see with their eyes have their gaze set not on Paris but on the computer screen. They processes wavelengths in false colours. They decode, manipulate, arrange, improve, extract, screen, then pass on the images to their colleagues in the next office, leading up to the printing stage and from there, eventually, to the sale. (no p.n.)

The SPOT operator, as Latour and Hermant stress, is only concerned with manipulating and preparing images for production. Their job is, rather simply, to 'process … wavelengths in false colours'. Evidently, then, they are working in the [REF] mode. Other Charter members, operators and specialists are also working in the [REF] mode; enrolled in transforming inscriptions into readable objects for other 'distant' users. But it

is only the SPOT operators who are tasked with decoding, manipulating and extracting the satellite imagery itself. In Latour and Hermant's case they are the distant users, shorn from knowledge of its production. In the UK flood event it is primarily the EA, but secondarily other on-the-ground organizations.

The risks in each case are not shoals or reefs as in November, Camacho-Hübner, and Latour (2010), but unsuitable wavelength categorizations or extractions. Nonetheless, they are approached in the same instrumental manner; as hurdles in a referential practice. It is through the translations intrinsic to these processes that the end users actually engage with the world-at-large. The world does not exist before these ways of sensing, even if the SPOT operators are indeed capable of seeing 'close up at a distance' as Kurgan (2013) suggests.

Meanwhile, on OSM, the flood extent across the entirety of the Somerset Levels had been traced from the EA maps and entered onto the platform by a single public user – 'Jestr88' – first coming to attention on 27 January 2014. Other, proprietary, platforms such as Google and Bing Maps do not map temporary events such as floodwaters at all, preferring instead to map only permanent features such as buildings, roads and bridges. Turn-by-turn navigation applications such as the Google-owned Waze, however, provide more accurate 'real-time' driving routes when faced with road closures due to flood events.[6] However, rather than re-rendering the base maps upon which the commands are issued, the platform simply brings up localized notifications to warn drivers and re-calculates routes around the affected areas. Nevertheless, as a predominantly mobile platform, its ability to react to temporary road events is vital to its functioning. As one of the authors has argued elsewhere (Hind and Gekker 2013), this is a collaborative practice in which users are encouraged to contribute to the platform by submitting road closures and mapping routes as they drive.

In OSM, the mapping of temporary features is a more contentious issue, with 'wiki'-style debates ongoing across the OSM community, as to whether flood events should be added to the mapping database (see OpenStreetMap 2014). On the 'UK Floods 2014' page on the OSM wiki, it is noted that 'temporary data does not belong in OpenStreetMap', reiterating in another section that 'data updates reflecting … temporary situations are not appropriate for the main OpenStreetMap database' (OpenStreetMap 2014). But despite this rather definitive language, Jestr88 was never asked to remove the data, and 'never got any aggro [sic] from the OSM community' for updating it (personal correspondence, 14 May 2014). The changes made to reflect the flood extent remained on the OSM platform for the duration of the floods.

In [REF] terms, there is no difference from the SPOT operators. Both use a set of inscriptive tactics, calculations and technologies in order to provide a distant user (Latour, EA and Somerset locals) with access to images of the world. However, if we employ Edney's (1993) framework, we can perhaps argue that the introduction of the OSM platform into the [REF] process actually constitutes a *different* cartographic mode to the one offered by the SPOT operators. Although Jestr88 traces the shape of the floodwaters from satellite imagery decoded, extracted and delivered through a 'top-down' supra-state disaster response mechanism, he does so in a public forum, on a 'grassroots' mapping platform, for the use of local individuals, many of whom had had trouble in finding out whether roads in the area were passable or not. Whilst the distinctions between these two agendas are clearly less defined than is often supposed – in fact, they constitute a kind of cartographic hybridism with the kind of 'crossborder traffic' that Latour (2013, 30) outlines – they nonetheless stand as separate Edneyian modes each with a unique set of cultural, social and technological relations.

The envisaged result of the OSM flood update would have ideally, for Jestr88, seen Somerset locals using the platform on a daily basis in order to navigate around the fluid situation. Road closures would have been reported and mapped quickly and smoothly, rising waters would have been captured by the French satellites, and newly passable roads would revert back to their original state. However, this didn't happen. Whilst many locals on social media had been asking for the same, basic navigational answers – 'is road X closed?', 'is road Y accessible?' 'how do I get to village Z?' – few people contacted Jestr88 to make more cartographic interventions, despite offers to add closures onto the OSM platform himself (personal correspondence, 14 May 2014). In the end, most navigational assistance was handed out through other mediums via a combination of word-of-mouth, road signage and social media platforms.

But why was this so? What was it about the updates that proved so unnecessary? The visualization of temporary features on OSM is rare. The failure of the map edits to provoke a wider interaction with the mapping interface points to the ineffectiveness of rendering temporary events. Focusing on the interface here, as offered as a productive analytical site by Dodge, Perkins, and Kitchin (2009), leads us to be able to investigate the nature of the failure. As the floodwaters receded towards the end of February, the edits remained on the map – this despite them being traced from satellite imagery captured on 11 January . Across this time, regardless of the inevitable ebb and flow of the floodwaters, the cartographic inscriptions remained frozen in time. Whilst they may have indeed stood as 'accurate' renderings of the flood extent as captured on that date by SPOT 5, from the moment they were uploaded onto the OSM platform, they depreciated in correspondence to the point of almost complete uselessness. In the narrow relative terms of the im/mutable mobility debate, the OSM platform is resolutely mutable: users can update the map as they wish. However, this case shows otherwise as the floodwaters remained on the interface for over 6 weeks, this despite their decaying utility. In one single move, as everyday life returned to Somerset, the edits were removed and the floodwaters vanished from the map.

These moments are indicative of minor glitches that provide a glimpse of an alternative account of the [REF] [REP] debate. In these instances, double-click is more precarious than is ever suggested by Latour who holds it up as a relentless and barbaric enemy. The transformation of these inscriptions failed on simultaneous levels. Whilst the traces of the floodwaters were indeed, at first, capable of being translated into mapped lines and areas properly denoted as 'lakes and reservoirs' under the appropriate OSM category, they ceased to properly correspond to the actually existing world. Alternative mediums were able to do its job far more confidently, with local knowledges supplanting the use of a digital map edits informed by satellite imagery. Whilst Hui's (2012) 'mobile practice networks' expertly challenge the assumption that, as the [REF] mode contends, actors desire to 'ensure coverage of great distances' (Latour 2013, 109) by bringing things (satellite imagery, map traces) back home to a calculative centre, it makes the same mistake as Latour. Namely, that success is the overwhelmingly dominant mode of operation. However, as is suggested above and will be further argued in the next case below, digital mapping failures manifest so frequently in the [REF] mode that the aura of unmediated access to worldly phenomena slips.

Volatile events

The Sukey application was a mobile application designed to keep demonstrators 'safe, mobile and informed' during protest events in London, UK. It ran over the course of three

years between 2010 and 2012 and was initially developed as a tactical response to police containment methods or 'kettles'[7] deployed during a series of anti-tuition fee marches in the winter of 2010–2011. This tactic, used most notoriously by Canadian police during the Toronto G20 (Smith and Cowen 2010), by the NYPD during Occupy Wall Street (Wood 2014) and during a series of other events in London, is designed to curtail the effectiveness and morale of protestors, by limiting movement and corralling individuals into a restricted space (Rowan 2010). As Wood (2014, 37) suggests, these methods are often deployed in order to gather evidence on activists, with those contained within the kettle often forced to surrender personal details in exchange for release. This practice, commonplace during the noted timeframe, is now illegal in the UK.[8] The act of kettling itself, however, still remains legal.

Initially, Sukey started out as a simple Google Maps 'mash-up'.[9] Updates on the incidents were posted to a timeline on the page alongside their locations on a standard Google Maps interface. Default symbols were taken from the standard Google Maps icon database for visualizing police vans, mounted officers, police dogs and barricades. This process has been repeated for many different events across the world, including in Libya (civil unrest, 2011), Boston (bombings, 2013) and Bangkok (anti-government demonstrations, 2014) – all representing a rudimentary form of digital mapping.

It later became a fully functional web-based application comprising Twitter updates, text alerts and a Google Maps interface. Information on a range of subjects, but typically in relation to the whereabouts of police units, and the direction of the main body of demonstrators, was posted by a core Sukey team. Updates could be sent by anyone via text or Twitter. Users on the latter were encouraged to tweet using a specific hashtag (#sukey, #sukeydata) in order for the team to be able to sift and isolate messages. Incidents were then verified by the team and retweeted to followers. The map itself would routinely update with an array of rolling features. Its most dynamic feature was a traffic light system employed to indicate possible pedestrian access along roads. Green indicated free access, amber suggested there were partial blockages, whilst red indicated movement was impossible. In this transition from a Google Maps mash-up to a full-scale application, the police tactics had not changed considerably, and thus the platform was able to maintain its significance as an 'anti-kettling app' (Doctorow 2011) locating and mapping any active containments.

At the time, Sukey exhibited the tantalizing possibility of 'real-time' spatial protest updates. Yet aside from passing references in Elwood and Leszczynski (2013), Ng (2014) and Reed (2014), there has been precious little analysis of its impact. Whilst many in the mainstream media proclaimed it a revolution in both digital technology development and protest tactics (Kingsley 2011; Geere 2011), there was little attention on the situated nature of its assumed success, and even less still since on the multitude of failures – at varying ontological, tactical and strategic levels – that can now be evaluated in the years since, especially in the light of more recent events on the streets of London.

Although the platform arguably amounted to a wider failure consistent with the overall ineffectiveness of student and anti-austerity demonstrations to cause any long-standing political change, this is not the 'failure' we wish to focus on here. Instead, in order to call attention to the often unstable nature of the [REF] mode, we intend to argue, in similar language to the previous flood example, that the temporary, fluid nature of events did not allow a 'successful' correspondence between inscribed data (coloured lines on a map) and signposts in the world (kettles, officers, protesters). The 'real-time' dimension of the

application proved unassailably difficult to implement. Due to the sporadic and 'rhizomatic' (Deleuze and Guattari 1987) nature of the action, the process of detailing, sending, processing and verifying events lagged significantly. In such situations, protesters needed to become aware of spatial threats as they occurred. The volatility of such demonstrations – critical to their functioning as disruptive practices – proved too difficult to render cartographically. They were, not unlike November, Camacho-Hübner, and Latour's (2010) mariners, engaging in wholly risky endeavours, with no way to map them accurately and appropriately. Whilst in other fields, this live capability might well have been sufficient – say, in the coverage of a political party conference speech or a football game – it was insufficient for a protest event defined in and through its intensity, volatility and unpredictability.

Crucially, this failure of real-time cartographic updates only allowed protesters to become aware of events *after* they had begun, rather than allowing them to anticipate and circumvent containments as they emerged. Although they nonetheless became 'mapping moments' (Dodge, Perkins, and Kitchin 2009) cartographically captured and visualized on a digital mapping interface, the platform was insufficiently conditioned to cope with the volatility of the event. In this case, [REF] broke down and the map could no longer be aligned with the volatile territory. Coupled with the difficulty of continually operating a smartphone during an evolving, and often dangerous situation, paying attention to spatial updates would prove too burdensome. Further, although many protesters across this period became cognisant of the way in which police units would prepare for imminent containment tactics (by lining up, unit by unit, in banks of two), and as such would be able to anticipate a kettle's formation, this did not always translate into stable cartographic entities in time on the digital mapping interface. Aware of the imminent threat of being kettled, protesters preferred, perhaps appropriately, to flee the area rather than to redirect attention towards their devices, submit information to the Sukey team and risk being trapped.

Attempts to turn London into a similar kind of protest space have been forthcoming in the period since Sukey's final deployment (UK riots 2011, Carnival Against Capitalism 2013), but with radically different spatial dynamics. The riot, the carnival and the trade union-led march are three wildly varying forms of urban protest events that also did not conform to the kind of spatiality necessary for the deployment of the platform. Although it is not the intention of this article to draw attention to the ways in which these did not provide suitable conditions for its use, it nonetheless remains important to note that Sukey was, and always continued to be, a situated deployment of a digital mapping platform *in specific response to* a series of temporary, fluid tactics enabling protesters to build an equally specific set of counter-tactics of evasion, avoidance and anticipation.

This failure to become a smoothly operating digital mapping platform disrupts the otherwise victory-orientated depiction seen in the [REF] mode. In this example, once again, we see the collapse of the double-tap enterprise in which the correspondence between event and digital map fails. The source of this failure of the [REF] mode lies in its inability to capture and render temporary phenomena (namely police containments) as objects in the [REP] mode. The protesters in these situations find themselves in a very similar position to those navigating the Somerset floods. Neither is enrolled in a fully functioning [REF] network that is designed to bring access to objects at a distance. Thus the mapping practice fails to reconcile a discordance between cartographic signposts as suggested by November, Camacho-Hübner, and Latour (2010). Casting these endeavours as unceasingly successful travails ignores the frequent and repeated failure of digital mapping platforms to account for momentary events.

Conclusion

In this article, we have primarily sought to bring Latour's *AIME* project into conversation with his previous expressly cartographic narratives, in order to argue for the relevance of a newly found ontological pluralism. Across the years, Latour has routinely returned to specific kinds of mapping stories with which to illustrate the key concepts of ANT such as im/mutable mobility, inscription and calculation. In *AIME*, he returns to mapping once again to explore what he now terms the [REF] and [REP] modes of existence.

In order to begin this conversation, we first argued that digital mapping could be conceived as perpetuating not simply a double-click philosophy, as in Latour's words, but a fully intimate double-tap mentality that, in turn, could obscure the [REF–REP] crossing spoken of in *AIME*. In public arenas, the use of digital mapping interfaces is routinely a double-tap endeavour, entailing precious little interrogation of the transformative dimension of such technology. The eradication of an external device such as the computer mouse or keyboard, and the uptake of touch screen technologies, specifically in a *mobile* setting, only deepens the illusion of direct manipulability. Worldly information is processed as immediate and unmediated representations of an external reality. This small tweak in terminology strengthens Latour's account of prevailing modern thinking, to allow for an even more robust analysis to take place.

Second, as we have argued here, Latour is not the first to think in terms of 'modes'. In cartography, both Matthew Edney (1993) and Martin Dodge, Chris Perkins, and Rob Kitchin (2009) have talked of so-called 'mapping modes'. Latour's ontological pluralism, together with these other cartographic and methodological versions, can help us to identify different operative elements in various digital mapping enterprises. We further argued that there is still considerable value in employing Latour's long-theorized notions of immutable mobility, inscription and calculation, so long as they are updated and refined to take into account their double-tap and mobile intentions, and the various bridging strategies to other 'modes thinking', mentioned above, are implemented.

Third, taking on a methodological commitment, we suggested that attending to the failure of mapping projects instead of comparative modal successes can yield profitable insights into societal, technological and political arrangements, unravelling the [REF–REP] crossing Latour speaks liberally of in *AIME*. As to illustrate this point, we looked at two cartographic cases elucidating the failure of [REF] and the precarity of [REP]: a UK flood event and a series of protest demonstrations, both of which saw deployments of very different digital mapping platforms, both notionally 'failing' due to their respective inabilities to capture temporary features and phenomena.

Latour's *AIME* points unequivocally to an ontological pluralism that must equally be supported by a new kind of cartographic pluralism that does not seek to impose any kind of theoretical framing on the subject without taking into consideration the many ways in which mapping events present themselves. Although key concepts at the heart of ANT – immutable mobility, inscription and calculation – have flaws, some of which have been noted by Hui (2012), and expressed within this article, an updated Latourian metaphysics has the potential to reinvigorate its methodological applicability; not least for those attending to the manifest plurality of digital mapping worlds.

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Notes

1. Although it is in his earlier paper 'What if we *Talked* Politics a Little?' (2003) that Latour first uses the term 'double-click', he does not fully develop an interrogation of its philosophy until later.
2. Thanks to one anonymous reviewer for this useful turn of phrase.
3. In *AIME*, Latour suggests jestingly that GPS may make mapping so anti-modal – in the spirit of DC – that it becomes unnecessary to look at the traversed landscape at all (Latour 2013, 76). This observation is actually in direct contradiction to November, Camacho-Hübner, and Latour (2010). Yet we can imagine that this will actually result in many hitches or trip-ups as our feet are still a central piece of equipment (cf. Ingold 2004) to align the chain of production and secure the 'network setup' (Latour 2013, 79).
4. In which Apple launched a new Maps application riddled with errors. Searching 'Apple Maps fail' brings up a whole host of blogs, editorials and news pieces devoted to listing these various 'fails' from pixelated images to misplaced labels.
5. It must also be noted that there are further attempts in the work of Kitchin, Gleeson, and Dodge (2013), Perkins (2014) and Lammes (forthcoming) to move beyond immutability mobility as a concept in mapping research. Hui (2012), however, goes much further in actually proposing an alternative concept rather than continuing to work with Latour's pre-given terms.
6. See: http://blog.waze.com/2014/05/waze-aims-to-help-bosnia-and-serbia-in.html
7. The German for the household kettle is 'Kessle' and its colloquial name has a connection to theGerman verb 'einkesseln' which means to encircle or surround.
8. See: https://netpol.org/2013/06/18/police-powers-finally-kettled-by-high-court/.
9. A term used to denote the way predominantly digital media – music, maps etc. – can be merged and mixed with other such media to form hybridized objects. In this case, how user-generated mapping data can be laid over pre-existing proprietary mapping data.

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