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**Title: Digital mapping interfaces: From immutable mobiles to mutable images**

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Sybille Lammes is associate professor at the Centre for Interdisciplinary Methodologies, University of Warwick. She has published on SF film, games and digital cartography. In recent years her main research subjects have been related to the new media and digital culture. Her research programme in computer games examines how games can function as cultural spaces for new spatial and postcolonial practices. In her latest ERC research project *Charting the Digital* she looks at how and to what extent digital mapping has altered meanings of media and cartography in daily life.

**Abstract:**

In this article I discuss how digital mapping interfaces ask users to engage with images on screens in far more performative and active ways and how this changes the immutable status of the map image. Digital mapping interfaces invite us to touch, talk and move with them, actions that have a reciprocal effect on the look of the image of the map. Images change constantly through absorbing our mobile and physical actions. I approach digital mapping interfaces as mediators: They do not so much collect information as create spatial transformations for the user of the interface, thus instigating new moves on his or her part that are fed once again into the interface. I argue that it is therefore short-sighted to view digital mapping interfaces as mere points of passage. They are better understood as mediators that create spatial meanings by translating between and inviting movements of users, vehicles, programs, etc.

Keywords: Digital mapping, cartographical interfaces, immutable mobiles, neo-cartography, inscription.

## **Digital mapping interfaces: From immutable mobiles to mutable images**

This article discusses how digital mapping interfaces invite users to engage with images on screens, and how this changes the status of the map image. Digital mapping interfaces invite us to touch, talk and move with them – actions that have a reciprocal effect on the look of the map-image that changes constantly through absorbing our mobile and physical actions. This transformability asks for a reconsideration of the map as a Latourian immutable mobile, a techno-scientific artefact that retains its shape in different contexts. As I will show, the image of the digital map may have become mutable, but this is only possible because the immutability of digital maps resides elsewhere. Digital mapping interfaces are mediators that process information from an assemblage of different immutable mobiles, such as satellites, program code and cars, and translate that into a moving and transformable image. Due to their processual and performative character, I will argue, digital cartographical interfaces should be approached as mediators that create spatial meanings by translating between and inviting movements of users, vehicles, programs, and other actors. As digital maps are simultaneously media, cartographies and technologies, this article combines perspectives developed in media studies, STS and critical geography to understand these processes of translation.

## **Cartography is not what it used to be**

Navigating through an environment with a map has taken on radical new meanings since the emergence of digital mapping practices. Analogue maps are designed with a fixed and predetermined layout of borders, centre, periphery, point of interests and so forth. One can read such maps, one can turn some of them around, one can even annotate them, or fold them, but otherwise their visual appearance and meaning remains pre-set and abstract. Cartographers, censors and so on, make certain irrevocable choices about what will be shown, and how; the map-reader is given a representation of spatial relations; and users can only marginally change such decisions. Indeed, as has been convincingly argued before, after the Renaissance maps gained an aura of seemingly objective and static spatial representations that all too often served particular ideological needs (Anderson, 1991; Crampton, 2001; Mukerji, 1989; Harley, 1989; Wood, 2002).

Digital maps no longer entail or promote such objectified and static representations of space. Whether it is a map on a navigational device that adjusts its route-display according to where the driver chooses to go, or a map in a computer-game that is partly created by players, maps have become interactive to the point that they are co-produced by their users. At home, at work and while we are travelling, maps have become more personal, transforming while we navigate with and through them. In short, digital map users do not just read a map – they constantly influence the shape and look of the map itself.

In this article I will investigate what has changed since the advent of digital mapping and how this transformative and personal ‘nature’ of digital maps should be

understood. To ascertain this, I will probe the status of digital maps as Latourian ‘immutable mobiles’, or as sign-things that keep their shape and meaning in different situations or contexts. By using the concept of the immutable mobile, I will show that, although digital mapping interfaces are certainly immutable and mobile, a subtle yet crucial shift has occurred as to where their immutability resides. Unlike ‘paper maps’ or many other analogue scientific representations, digital images have gained a degree of mutability, thanks to a network consisting of an assemblage of plural immutable mobiles. Such networks of immutable mobiles form ever-changing connections, a process that allows the image to become animated and layered with ephemeral information for and about the user. In other words, digital maps are a different kind of immutable mobile, putting the mobility of users *in* the map through complex and shifting alliances between different immutable mobiles.

As I will show in this article, the interface is a crucial ‘fulcrum’ for understanding how these different immutable mobiles are aligned and offers a helpful and new perspective to understand mapping in the digital age. Because cartographical interfaces afford (Akrich and Latour, 1992) specific translations between different planes of spatial knowledge (such as users’ input, satellite signals and computer programs), digital maps can constantly change their visual appearance. I will therefore in particular look at the role of interfaces in this navigational process and ways in which images are produced via the interface as a Latourian sign-thing inscribed with socio-spatial ‘programs of action’ (Latour 2005; 1999; 1993) by which I mean that their agency prompts actions from and translations between users, software, remote machines and so forth.

## **Cartographical interfaces**

Both digital maps and analogue maps can be viewed as cartographical interfaces, or points of contact, which are ‘consulted’, and, through which spatial relations are understood and produced. It is precisely the status of the cartographical interface which has changed considerably by the advent of the digital. While analogue maps are often (although maybe erroneously, c.f. Kitchin et al. 2013) viewed as flat representations of space that ‘mirror’ a certain fixed – and often ideological – view of the world, which can only be altered ‘on the surface’, digital maps both foreground the multi-dimensional and flexible character of the cartographical interface. They are multi-dimensional, because they mediate between different techno-scientific levels: what, for example, goes on ‘underneath’ (programming, wiring) is always coming to the surface in new ways when new input from ‘above’ (from the user or from GPS), or from a parallel realm (e.g. the weather forecast) is given. They are also multi-dimensional interfaces because of their flexibility in incorporating and merging this input and output, constantly adapting to where one is headed and what one is doing.

Instead of simply showing ‘frozen’ spatial information, interfaces now also perceptibly take part in the creation of spatial relations. In this process, map images become dynamic hybrids of multi-dimensional inputs that merge in ever-changing ways. All this makes it highly problematic to speak of digital mapping interfaces as *representing* spatial relations. Rather, they *co-produce* “spatial formations” (Thrift, 1996) and are mediators via which changing images are produced, combined and merged in ever-shifting spatial associations.

## **Material interfaces: Ideals and ideas**

In new media studies, as well as in the area of engineering and computer sciences, a persistent idea can be discerned that perceives digital interfaces as being transparent membranes or reflective surfaces, downplaying their mediating function in co-producing spatial formations. Obviously, computer sciences hold on to this ideal from the conviction that the interface should be a well-oiled means of communication that merges invisibly and effortlessly with daily practices and creates an experience of “flow” (Csikszentmihalyi, 1997). To conceive of them as having agency does not agree with an effort to close ‘black boxes’, with the purpose of weaving them seamlessly into daily practices. Or, as Søren Pold (2005) stated in his article “Interface Realisms: The Interface as Aesthetic Form”:

Making the interface, its expression, and materiality more functional and transparent has been key to interface design and the accompanying academic discipline, HCI. In the broader cultural and social understanding of the computer, the tendency has been to understand the interface as transparent, preferably invisible, in order to produce a mimetic model of the task one is working on. Interfaces should be intuitive and user friendly, should not "get in the way" or otherwise be evident or disturbing. (n.p.)

As Pold convincingly argues, this ideal of transparency may have some value for designing interfaces, but is limited as a theoretical concept because of its presumption that interfaces are, or should be, mimetic screens or representations of reality that are non-intrusive and invisible. Such an ideal is inadequate because it does not acknowledge “that the interface changes what and how we see, how we experience and interact with reality, and how this reality is reconfigured through the computer”

(Ibid., n.p). In other words, most HCI disposed studies of interfaces do not approach the interface as being a constructive mediator via which an “assemblage” of actors is formed in ever shifting relations (Latour, 2005: 7,8,43).

The inclination in new media studies to view interfaces as translucent, mimetic or empty vessels, has a parallel yet slightly different background. Since new media studies started to emerge as a field of studies in the nineties, a tendency can be discerned to view new media and digital cultures in either utopian or dystopian terms. New media cast their spell, triggering such idealism that the hopes (or fears) of thinkers assume proportions that have little to do with how new media are actually rooted in everyday life. Ideals of communication often loom so large when technologies are new (Marvin, 1988) that they leave little space for considering them as technologies with agency. It is for this reason that discussions frequently focus on how new media, such as the Internet, generate new virtual experiences of space that are supposedly distant from everyday material realities (Fuller 2005). In relation to space, scholars even argue that new media deprive us of a sense of place. Through their global and ubiquitous use, and through representations, they are said to create “geographies of nowhere” (Augé, 1995; Eberle, 1994; Kunstler, 1994; Kupfer, 2007; Meyrowitz, 1985).

Theorizations of interfaces follow this tendency. “Interface” and “interface culture” were already much-heard buzzwords in the nineties, but until lately their definitions have adhered to this view of interfaces as transparent and empty vessels. In his book *Interface Culture* (1997), for example, Steven Johnson speaks of the qualities of interfaces as “the anonymous middlemen” that gives use unmediated access to a



“parallel universe” that would otherwise remain “invisible” and “outside our perceptual grasp” (p. 19). Hence the interface is defined here as a window to another world, a representation of what otherwise would remain ‘out there’ in outer space. Such approaches understand interfaces as bringing us direct, unaltered and immediate access to other realms of knowledge or information. We just have to click on an icon to be brought there or for ‘it’ to be brought to us. Latour calls this way of thinking “the double click” mode: “this Evil Genius is going to whisper in your ear that it would surely be preferable to benefit from free, indisputable, and immediate access to pure, *untransformed* information” (Latour, 2013: 93). In line with this double click ideal, such theoretical conceptions of the interface don’t do justice to the fact that information is always transformed *via* the interface. Or to use a Borgesian cartographical allusion: the map – as interface – can and will never become, the landscape (Borges, 1975).

Manovich’s work on the screen as interface follows a somewhat similar problematic track. In “An Archeology of a Computer Screen” (1995), he argues that computer screens are part of a historical discourse of the screen that also includes cinema. So far, so good. Yet he also defines the screen, and particularly computer screens, in a highly transparent and non-intrusive manner. In this still much-quoted article, Manovich uses the metaphor of the window to describe how screen interfaces function. Again, the ideal of the screen as transparent and indiscernible is put forward. Furthermore, it is once more a window to a kind of otherworld, database or source of information that has no function in producing images, text or information (p. 124) in itself. Similar to Morse in “Body and Screen” who calls the screen “[t]he interface between this world and the other world” (ibid.), his argument still fits the dominant

strand of thinking, in which the interface is theorized as an immaterial and one-dimensional membrane or surface, visually and directly representing realms that would otherwise remain invisible. Such understandings of interfaces don't acknowledge their processual (Thrift, 2008) qualities in the production of such visual information and in producing the illusion of immediacy.

Representational (or mimetic) understandings of interfaces have governed the field for a long time and have by no means disappeared as a dominant discourse from media studies (see for example Drucker, 2014). Yet lately some authors have distanced themselves from this conception of the interface as a representational portal of visual information (Galloway, 2012; Hookway, 2014; Farman, 2010). My understanding of digital cartographical interfaces as Latourian sign-things that are inscribed with socio-spatial 'programs of action' (Latour 2005; 1999; 1993) fits into this recent way of thinking. I approach digital mapping interfaces as mediators in transformative practices. Their thingy-ness –as neither object or subject - is important to stress here, as acknowledging this allows us to move away from the above described understanding of interfaces as empty vessels, windows, or membranes that just channel a realm that is believed to exist a-priori to the channelling. As sign-things or quasi-objects ((Latour, 2003: 52; Serres, 2007: 224-234), interfaces have agency in how meaning is produced and are not just representing visual and spatial information, as the window or mirror metaphor seems to suggest. As such they also entice us to produce the landscape we engage with in particular ways, as they invite us to make specific translations that call both the landscape and the map into being. Mapping interfaces proscribe certain spatial actions (e.g. 'turn left', 'touch me', 'take me out of here') and thus invite certain interactions between map source, user,

environments and other humans or things. To view interfaces as technological artefacts that act as such mediators – creating and proscribing references between users and spaces – allows us to acknowledge their agency and to move away from a predisposition to conceive of the transparent and non-intrusive mirror or window as “the archetypical interface” (Cypher and Richardson 2006, 2). Considering interfaces as more than just “windows” (Manovich 1995), “broken mirrors” (Morse, 1999) or “anonymous middlemen” (Johnson 1997, 19) that lead to other worlds, allows us to conceive the materiality of interfaces and to approach them as human-made and used things, as “sticky” (Chesher, 2004; Cypher and Richardson, 2006) and tactile creators of spatial relations. Thus we can avoid viewing them as empty vessels that let interaction ‘come to pass’ – a prevailing idea and ideal in both new media studies and engineering and computer science (Pold, 2005) that hinders our understanding of digital interfaces as processual and non-representational mediators (Thrift, 2008; Harrison and Anderson, 2012).

This non-representational conception of interfaces resonates with Galloway’s comprehension of interfaces as mediators through which networks come into being and his assertion that we have to acknowledge their changeability to understand them properly in relation to power (2012). Yet while Galloway speaks of interfaces as effects, I prefer to speak of them as sign-things in order to stress the agency of interfaces in making meaning. This may at first glance seem less compatible with Galloway’s interpretations - he speaks of effect as a means to steer clear of an object orientated conceptualisation of the interface which hinders us to think about the transformability of interfaces as mediators. Yet, the term ‘sign-thing’ or quasi-object doesn’t equate with how Galloway comprehends objects (hence the term ‘thing’). It

goes beyond the object/subject opposition and perceives things as relational and as having agency. Analogous to how Serres describes the ball as a quasi-object, the interface, when picked up and touched becomes “subject of the body, subject of bodies, and like a subject of subjects. The laws are written for it, defined relative to it, and we bend to these laws” (Serres, 2007: 225). Likewise, the interface invites users to perform certain bodily actions that are then inscribed in it and become mediated through it. Through doing this it also defines us relative to it, telling us to which rules to obey (or to deny), such as touching it in certain ways or choosing to take a particular itinerary. These actions also reciprocally transform the map image. A conceptualisation of the interface as quasi-object allows us to think of interfaces in terms of changeability and effect whilst at the same time acknowledging their materiality as things. Most importantly, it points to the interface as having agency, an important feature for understanding the workings of power. The question remains however what they invite users to do and to what extent this gives users power to play with networks of control and to re-negotiate their shape. The ball hardly loses shape when being played with and moved around, yet digital mapping interfaces allow for more input from users through their interactivity. The question then arises how and to what extent they allow us to renegotiate their shape.

### **Immutable mobiles: From layering images to inscribing images**

Clicking on a mouse, touching a screen, pushing buttons, speaking to an interface: users of digital mapping interfaces are invited to undertake all kinds of actions that reciprocally affect the appearance of the map. Here lies a clear difference between ‘old’ and ‘new’ cartographical interfaces. Older mapping interfaces consist

predominantly of a one-dimensional surface that ‘holds’ the image of the map. This surface invites users to read, touch, look, flick through, fold etc. But such activities don’t have a great reciprocal effect on how the image of the map looks. Digital mapping interfaces, on the other hand, involve far more than a flat image of the map and are therefore far more multi-dimensional and flexible than analogue maps - the casing behind the screen with hardware, electricity cables and many other things make up a network with which the user can connect, and actually can call into being, via the interface. Through this network, we transmit images that are constantly transformed by the collaborative input of humans and other things (e.g. roads, satellites, radio signals of traffic jams, other computers). All this extra ‘stuff’ surrounding the image actually serves only one purpose, and that is to make the map image transformable with and for us, foregrounding the processuality of the digital image.

Because of this transformability, digital maps are no longer classical *immutable mobiles*. In “Visualisation and Cognition: Drawing Things Together” (1990) Latour described what he means by an immutable mobile by taking the example of La Pérouse, who travels to the Pacific to bring back a better map to the King of France. When he tries to ascertain whether a part of China is insular or peninsular, a local draws him a map of the area:

An older man stands up and draws a map of his island on the sand with the scale and the details needed by La Pérouse. Another, who is younger, sees that the rising tide will soon erase the map and picks up one of La Pérouse’s notebooks to draw the map again with a pencil. . .

(p. 24)

Latour argues that the difference between the project of La Pérouse and what the locals are doing lies not so much in that the Frenchman has more knowledge of how to draw maps, but in that he wants to be able to take a map back to France so that others can use his knowledge. The locals have no need for that and can draw maps any time they want. For them it doesn't matter if they are wiped out by the sea. To be able to take a map back, La Pérouse has to make an inscription, a map as a thing that does not change shape when transported. For him to achieve this, the map has to become both immutable and mobile. Thus it turns into a representation of that particular area of China, one that can be transported.

Latour states that particular traits ensure that a thing becomes an immutable mobile. It has to be a *flat inscription* that can vary in *scale*, it can be *reproduced*, it is *re-combinable* and it is *super-imposable* with other inscriptions (37-38). When we look at digital map images, we can indeed agree that they are predominantly flat and re-combinable and that their scale may be adjusted. It should however be added that the user as cartographer now has a certain say in how scales vary (zooming in) and in which images are combined and superimposed (layering).

Yet two features – inscription and reproduction – need reconsideration. First of all, digital map images cannot always be viewed as straightforward inscriptions.

Certainly, some digital maps still depend heavily on flat inscriptions. This is most notably the case with Google Earth. It is actually a simulated 3D digital globe on which a multitude of inscriptions are superimposed or layered. Perfectly in line with

Latour's definition, the globe itself and its basic cartographical features are immutable yet super-imposable and re-combinable. The range of views and the degree of zooming and moving have increased spectacularly in the case of Google Earth, but as a tool and toy it still depends heavily on reproducible inscriptions. It is a perfect example of Latour's claim (1997) that, since the digital turn, the term "immutable mobile" has not been made redundant, even if velocity has increased tremendously and other connections may be privileged:

[i]f we say that, in order to make visible a collective of 5 to 10 billion people, in the long history of immutable mobiles, the byte conversion is adding a little speed, which favours certain connections more than others, then this seems a reasonable statement. To say that we are living in a cyberworld, on the other hand, is a complete absurdity. (n.p)

Indeed, one could state that in Google Earth the practice of hybridization, which according to Latour has always existed, is sped up and augmented to a far greater extent. The connections that can be made have altered (e.g. webcams, photographs) and the rate at which images can be added and re-combined has accelerated. Yet, in essence, the images that are re-combined via Google Earth as an interface are still inscriptions that are re-producible.

Nonetheless, even in the case of Google Earth, hinging as it does on a multitude of visible and re-combinable layers, the status of the image has changed. In the simulative environment of Google Earth, a user can draw extensively on the cartographical layout of the world as a surface, overlaying it with photographs, icons,

films and games. Such traces are left *on* the surface and not *in* the surface but it becomes very difficult to reproduce the re-combinations that users generate afterwards. Thus Google Earth is still an immutable mobile, but the characteristic of reproducibility is downplayed while layering (Verhoeff, 2012) as a way of re-combining images is foregrounded.

Similarly satellite navigation devices such as [TomTom Go Live](#) invite users to interact with a map-image that is constantly recombined and layered with other images such as 'real-time' traffic updates. Here the mapping interface produces a moving image similar to the view through a car-window: the route and landscapes ahead can be seen as an abstracted cartographical visualisation. A red road and arrow indicates where we are headed, imaginary buildings indicate that a city is traversed, while trees and green patches signpost that the user is traveling through a less populated area. By touching the display or speaking with the interface (similar to Google maps voice recognition or Siri) we can find another map and route, zoom in and out, add points of interest, or check the weather forecast. All this extra information is superimposed on the map of our route and constantly updated. Yet the process of recombination of which Latour speaks in the above citation is even further accelerated: as a result of the mobility of the user *with* the cartographical interface the image of the navigated map changes rapidly and irretrievably. Translations between mapping source, GPS signals, velocity of the driver and crowd-sourced data of other drivers are constantly uploaded to our screens to create the impression of a moving image of the environment through which we traverse. As with Google Earth, it accentuates the re-combinable trait of immutable mobiles, whilst downplaying the trait of reproducibility.



Although a satnav like TomTom invites users to give some implicit (e.g. speed) and explicit (e.g. naming destination) input, the asymmetry between producer and consumer remains largely intact. It is a fine example of the Latourian double-click mode earlier discussed in this article, enticing drivers into believing that information comes to them in real-time, unaltered through the Tomtom interface. Tomtom controls the network that produces the moving image and retrieves data from users, while that process remains mostly out of sight for the driver, as long as no glitches occur (Hind and Lammes, 2015). Tomtom – as an assemblage of software, people (e.g. drivers, TomTom personnel) and other things like satellites, sign-posts and speed-camera's – places layers on the image of the map and control the parameters of this 'looping' process. As users we are largely at the mercy of the interface effects they wish us to abide to and have restricted power over the chains of production that bring the image of the road ahead of us into being, which is of course not necessarily a bad thing in terms of road safety and risk minimization.

Yet the social navigation app [Waze](#) shows that such asymmetries between interface producers and users can be less stark and that users can also become more actively involved in making their road trip safer and more efficient. Or as their logo says: "Outsmarting traffic together." Waze is a gamified app for smartphones asking drivers (or passengers) to make traffic updates via the Waze interface in a bid to earn points and upgrade their status. Now users can see their "spatial self" (Schwartz and Halegoua, 2014) and that of other drivers as images of vehicles in the map and can feed layers of text into the map (e.g. "heavy traffic", "vehicle on hard shoulder") to help other drivers on their way (Hind and Gekker, 2014). So, Waze users are more

actively participating in the chains of production (November et al., 2010) that generate the map image than TomTom users are. Yet Waze is still very much akin to TomTom, in that the users may cover the map with their own updates, but can't change the map itself *permanently* on the level of inscription. The feature of reproducibility is again toned down as the image of the map changes constantly and cannot be 'played back'. Markers and indicators come and go while we drive, but are irretrievably wiped of the surface - like pins or pawns on a paper map - once the journey has come to an end. Thus the basic map remains immutable as users can't bring permanent changes to its basic structure.

This nevertheless changes when users become active map editors and are asked to change the map in a more lasting way. Then the power of the user increases and cartographical interfaces can become more mutable as sign-things. A good example of this is the additional [Waze Map Editor](#) (WME) which aims to go further than just gathering GPS data from users on the road for map improvement, and also asks users to "to edit maps of their neighborhoods, cities or other places with which they are familiar." So here a mapping interface acts as a mediator, inviting users to alter maps of areas that they traverse in an attempt to increase the efficiency of the mapping interface. Nevertheless this crowd-sourced information is still controlled, traded and censored by Waze (Morabito, 2015; Silva et al., 2013). In this sense Waze, editors are more like cheap laborers than full-fledged participants and upward chains of production remain partly opaque.

Whilst Waze Map Editor bears a strong resemblance to how open source mapping project [OpenStreetMap](#) (OSM) operates, this is exactly where they deviate. Arguably OSM leaves more possibilities for users to get involved in chains of production as it is

fully controlled by its multitude of users on a non-profit basis. The question then is whether this makes OSM less of an immutable mobile. The answer to this question is twofold. First, one could maintain that OSM is still an immutable mobile because it hinges on a multitude of visible and re-combinable layers and flexibility of scale. Users can zoom in and out and can choose to put different existing layers on the map for walking, cycling or driving. Like in [TomTom](#), [Google Earth](#) or [Google Maps](#) the image of the map is also arranged according to certain pre-determined gridlines that cannot be changed. So in that sense the map is as much a mutable mobile as the other ones discussed in this article. Yet, in OSM, the mapping interface is definitely inviting users to make the map more mutable because the user is now also actively encouraged to contribute in-depth inscriptions to the map. Or, as the opening webpage states: “OpenStreetMap is a free worldwide map, created by people like you.” This suggests an input of users which goes much further than the activity of layering, such as that being used in the Google Earth outreach projects “[Save the Elephants](#)” (2013) in which the mobile GPS traces of elephants tracks are overlaid on the GoogleEarth globe surface, to be removed by users at their wish. OSM users are invited to make map inscriptions instead of only adding superimpositions and are able to follow such processes. They can upload updates that change how the map looks as an inscription and therefore have more power in how ‘the world’ is being viewed. A good example of this is [WikiProject Gaza](#) where OSM mappers changed the map of the Gaza strip to improve humanitarian relief (OpenStreetMapWiki). Users thus have possibilities to become explorers and cartographers who can alter the meaning of the map by inscribing changes. The traces they leave cannot be easily removed. This position of OSM mapper actually somewhat evokes that of the young Chinese men in Latour’s story that makes a drawing of the island in La Perouse’s notebook for him to take

back to France. Similar to this young man, OSM users that are not necessarily map experts are encouraged to make map inscriptions and to become mediators or translators. Since contributors to the map make these alterations in the surface instead of on it, cartographical images become less asymmetrical inscriptions and regain at least a taste of mutability.

What is important to note here is that a large group of OSM users do not wish to become actively involved in such map-making practices. As Perkins and Lin have pointed out, both the degree that OSMers wish to engage with the interactive possibilities of its interface can differ, as well as the level on which this interactivity is sought (Perkins, 2013; Lin, 2015; Perkins, 2011). In every day life many of us may not want to become “vernacular” mappers (Gerlach, 2010), instead wishing to keep the chains of production out of sight in the name of efficiency and ease of use.

Yet, while not all users may wish to dig deeper into mapping technologies, and the OSM community is a highly diverse one, the OSM interface definitely still offers users the possibility to become more involved in shaping the map, following and adding to inscription processes through volunteered geographical information (VGI). Most importantly, OSM mappers can leave traces of what they have changed *in* the map for others to see through the option of GPS traces and by looking up the name of a contributor to see what she exactly did for the map and which inscriptions were left when and where. Also users - as groups or individuals - can help developing software for OSM (Haklay and Weber, 2008). Unlike a conventional analogue map where such inscriptions are ‘depersonalised’ and we cannot easily know which assemblages of actants established it as a ‘thing’, in OSM, upward chains of production are a partly traceable process that is even celebrated in particular OSM communities. So, if users

want to take up the invitation, OSM can be a far more inclusive and collaborative mapping platform than the others discussed in this article. The process of inscription becomes mutable and traceable, as if we can follow the map being drawn in the sand. But does this higher degree of participation in inscriptive production processes mean that OSM has become *mutable* mobile? I would argue it hasn't, yet that it generates a somewhat different kind of immutable mobile from the archetypical one that Latour describes. What is crucial here is that the map image can be altered on the level of inscription so that others can use his knowledge. So the scientific status of the map does not suffer from this mutability as it is still intended to make a map that can be used in different contexts and situations. To return to Serre's trope of the ball, one could state that users still have to bend to the Euclidian rules of the map: like a ball, you can pick it up and leave it in shape or start polishing, carving, and layering its appearance, as long as it stays 'round'. OSM is very much geared towards creating a complete and adaptable map through collective knowledge production, and adheres to a positivist ideal of what a perfect maps should be like, aiming to erase errors through multiple editing (Mooney and Corcoran, 2012) and creating the best map of the world. Although this process may have become more transparent and dynamic, the aim is still to create a map that is usable in different contexts and thus an immutable mobile. Even more, its VGI interactive features, one could argue, makes mapping an even more real-time "double click" experience in which flooding risk can for example be incorporated as a superimposition on maps when they occur, to be erased when they are no longer 'there' (Schelhorn et al., 2014). No way does the OSM community have the intention to create instable maps that are either mutable or immobile. It actually is a strong example of how the acceleration of bytes allows us to speed up processes of fine-tuning immutable mobiles. It also alludes to a change in how we

engage with technologies and power in the digital age. Apparatuses of control (Foucault 1980; Baudry 1976) have been partly replaced, by ‘networks of control’ (Galloway 2004) that are far more dynamic and have the potential to distribute power differently. Nowadays we deal with interactions within fluid networks of media technologies in which users are embedded as participants. As the difference between Waze and OSM shows, how we play with and within these networks depends on what interfaces allow us and invite us to see and do. They don’t necessarily give us more power in how we want to perceive the world, but definitely open up possibilities to be more engaged with the making of ‘facts’. Since OSM invites users to engage with mapping inscriptions, it definitely offers new possibilities to follow and engage with chains of production that traditionally have been largely out of sight. Yet these chains of production are still established through networks of immutable mobiles, networks that allow users to become nodes in this network and getting involved in co-shaping the alignment of immutable mobiles and co-producing the map image through the interface.

### **To conclude**

As I have shown in this article, cartographical interfaces invite users to a higher or lesser degree to give input that changes the map image and puts users in the map. This can be so because the immutability is stored elsewhere in the network, in the program’s parameters, on the satellite, and in the casing of things (the hardware) that frame the cartographical image and makes it (to a greater and lesser extent) transportable (Akrich, 1993). So inscription still plays an important role in digital mapping interfaces, but it *has shifted location*. Certainly the image itself is no longer an inscription in the way that Latour meant it, but the digital mapping interface as a

whole remains an immutable mobile by employing different kinds of inscriptions, which together, as an assemblage, ensure what Janet Vertesi called the “image’s indexicality, which changes in an appropriated (but still expert) context of use” (2008, 25).

Although the image itself may have become mutable since the advent of digital mapping, the digital map as a network of control is still immutable for the map source is stored in a database (e.g. Google Maps) that is not easily transformable and operates according to set rules. Artificial satellites as (semi-) separate computer systems transmit coordinates according to fixed parameters, and Wi-Fi access points and mobile phone masts transmit and receive signals according to pre-set protocols. All these artefacts are indeed immutable, asymmetrical inscriptions over which users have little control. The digital maps for car-navigation, for example, are produced by only two companies, which control the stability of the *fond de carte* (Thielmann, 2008). Satellites – expensive, complex artefacts orbiting the earth – are even further out of reach for the overwhelming majority of users (Parks, 2005). It follows that in most cases users of digital maps cannot and do not want to influence or even understand the “long and costly chains of production” (November et al, 2010) involved in the establishment of such immutable mobiles. Yet via the interface (as mediator), they combine these various immutable mobiles into ever-shifting networks to create mutable images of maps as geo-collaborative practices.

To paraphrase Latour’s statement about the Chinese map: because digital mapping interfaces are programs of actions that connect and translate inscriptions of computer code etc., it doesn’t matter that travellers constantly wipe out the image of the map. New connections and translations can always be made between satellites, users and

program sources to retrieve new coordinates and images. This makes digital mapping interfaces highly immutable and highly mobile, although the digital image in itself has become more mutable and less reproducible. Storage is situated elsewhere, and at the hands of the user the image of the map has become a transformative surface for transmitting locations.

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