The Uses of Geomedia:
An Object-Centered and Situated Approach

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Abstract

Media rich geographical environments and mobile Geomedia are suspected to change the way we encounter cartographic material. Thereby, commercial geomedia such as Google Earth promise to work as devices that not only facilitate the access to geographical material, but provide interactive platforms that makes it easier to handle and comprehend spatial relationships, and, at the same time, reconfigure our understanding of space and location. The paper argues that these developments demand an overall shift from the fixed functional approach of map use studies to a more dynamic view on geomedia usage that becomes inevitable through new practices such as geobrowsing. This claim is reviewed, drawing on Science and Technology Studies, and, in particular their research branch Actor-Network-Theory, to give further insights in the handling of geomedia, against the backdrop of the socio-technical context in which the objects influence our everyday encounters with the outside world.

1   Technological Change and a Shift in Map-use

Due to technological developments of the digital media upheaval since the first Geographic Information Systems in the 1960s, new ways of using geographic media become visible. On the one hand, aesthetic convergences have become evident, for instance the combination of genuine cartographic inscriptions with photographic and sensorial images and 3D computer graphics; on the other hand, there is a gradual alteration of authoritarian modes of production that lower the bar for cartographic amateurs to participate in map design and diffusion. The latter became possible through the client-server architecture of networked infrastructures, and with the introduction of the geostack which includes tools relatively easy to use by the geographic layman (TURNER 2006). For example, digital globes are increasingly enriched with different types of media, and, as a result, transform into complex geographic platforms. Geobrowsers like Google Earth can be thought of as conglomerate surfaces that combine old and new media, thus producing distributed aesthetics that emerge from technologically enabled means of combination, recombination, and hybridisation of different media. Data and services become intermingled in mashups that exceed common notions of remediation (BOLTER & GRUISIN 2000) since novel features and functionalities are not only added to existing visualization, but new means of interactivity are introduced that enhance the overall user experience.

New user practices are emerging as a direct consequence of cartographic inscriptions in af-filiation with other types of media. To stick to the example, the available joysticks in geo-browsers can be described with the notion of the virtual camera which makes it possible to navigate through the geographic content in novel ways, a practice that can be called geobrowsing (PEUQUET & KRAAK 2002). Understood as a way of using visual geomedia, this neologism reveals itself as an ambiguous practice. The prefix points to the horizon of geographical space, or, to be more specific, its presentation on a geomedial platform. The verb 'to browse' can either be translated with 'to look something up in a database' or with a less targeted flipping through the contents (FISCHER & HOFER 2008). Geobrowsing is reserved for the latter, „We pan the map, zoom in and zoom out, and change colors. All of these involve ‚playing' with the map to allow latent relationships to emerge. There are other ways of manipulating maps for this purpose that we may not ordinarily do – turning the map upside down and sideways, for example" (PEUQUET & KRAAK 2002: 82). Geobrows-ing makes visible that the map shifts from a pre-fixed representation towards a more open presentation that leaves room for interpretation (WOOD/FELS 1992).The notion of play-fulness and emergence makes evident that the question of map use is evermore becoming bound up with interactivity, and that today researchers in this field are faced with con-templative forms that cannot be explained within a functional framework to map reading.

Therefore, contemporary concepts of map use in the digital age emphasise the act of look-ing and the affective qualities of maps and other geomedia (AITKEN & CRAINE 2009; CART-WRIGHT 2010). This shift in descriptive language is not superficial, instead should be under-stood in methodological terms, placing emphasis on contemplative forms of media use and aesthetic transformations. It echoes the disciplinary change from representing towards vi-sualizing as a central task in map production. At the same time, it becomes visible that historical dichotomies between the map as a scientific inscription, on the one hand, and artistic presentations of space, on the other, increasingly vanish. It slowly becomes visible that this puts in question the very foundations of research into map use. If the map does not have the 'gestalt' of a flat inscription any more by converting into a 3D image, it steps out of its role as a neutral mediator and develops into a space of action on its own right (WIN-TER et al. 2009). A space which permits certain actions, and modes of reception, but pre-vents others. This only becomes visible when the surface of the image offers itself for han-dling, and is recognised as a material object, in the sense J.J. Gibson summarises: „Pictures are *on* a surface whereas substantial objects *are* a surface. Moreover, pictures *stand for* sub-stantial objects in addition to *being* substantial objects" (GIBSON 1951: 409, italics in the original). Gibson accentuates the ambivalent materiality of images in general: While recog-nized as surfaces on a ground they constitute material objects on their own right that can get handled as such by the users.

2   Geomedia in Everyday Flows of Action

2.1   Technologies and situations

Investigations into the science of technology reveal that new technologies have to proof themselves useful within their user-involvement, and, as such, their development phase extends well into the actual use (RAMMERT, BÖHM & OLASCHA 1991, RAMMERT 1993). The interaction between users and technology can be described as the confrontation of a human

with a contingent system that is not apprehended and used in only single manner, and, therefore, has the tendency to stay underdetermined (LUHMANN 1984). It is obvious that this holds for technologies with a certain degree of complexity, and lots of possibilities for modification and personalization like interactive media. And the same is true for many mobile geomedia applications in which the geographic layer is just one part among other functionalities and which can be applied in diverse spatial contexts. This mixture leads to uncertainty that demands decisions and a stronger agenda setting on the side of the users. In geomedia oftentimes the burden of choosing the right visualization and the appropriate content in a given situation is increasingly handed over from producer to the user. Was it traditionally the map maker's turn to decide what to depict on a maps surface, now it is on the user to find an individual way of arranging the contents offered for display. But also stationary use of relatively complex systems is not bound to a priori scenarios. The openness and unmarkedness of many geomedia applications – including and foremost digital maps and geobrowsers – lead to a situation in which the specifics of an application are not fixed anymore, and strongly depend on the socio-technological contexts of its use. For example, in the environment of TV and film productions, Google Earth is used for location scouting, and while companies selling solar panels compile cost forecasts with the help of its satellite imagery, zoologists analyse the magnetic alignment of mammals on pastures all over the world (BEGALL et al. 2008). Traditional methods of map use research that rely on individual, cognitive approaches will find it hard to keep track of these developments. Besides, there are a variety of other contexts where maps have always been used in a different way than the dominant functional approach expected. The map as a working image is just one side of map usage. Digital maps and globes, and especially locative media applications are said to revitalize the notion of map use as a form of distraction, contemplation and pleasure, incarnated by the historical figure of the armchair traveller (KEHLMANN 2005). There are plenty of contexts including artists' engagements with maps, map collecting, or social geomedia that pose completely different questions for studies in map usage (PERKINS 2006). The new set of options for the armchair traveller of the digital age still remains rather uncharted territory for research in map use and geomedia (GOODCHILD 2008).

2.2   What does technology do?

Since user-interface issues like the ones mentioned above are increasingly pushed upon map designers as well as geographic educationalists (CARTWRIGHT/HUNTER 2001), it is worth to look at the concepts and theories of map use research in order to adapt to the pragmatics of today's geomedia. The paper argues that a stronger situated and object-oriented view is needed, to take into account the social contexts of map use, as well as, the various forms of initiative on the side of the medium which can be subsumed under the umbrella term of 'material agency' (SUTTON 2008). To grant agency to things leads to concepts firstly introduced by non-anthropocentric theories in the Science and Technology Studies, reverberated and emphasised by the Actor-Network-Theory. But this does not necessarily mean to reject cognitive approaches that traditionally serve as a basis for research into map use (MONTELLO 2002). In cognitive psychology there is also the concept of distributed cognition that includes different levels of object agency integration. For instance, Edward Hutchins shows that the practice of navigation is distributed throughout cognitive processes and our socio-technical world. While drawing on Soviet activity theory, Hutchins states that motives and activities are not intrinsic and isolated processes alone, but closely bound to the social context of a person. Then Hutchins moves on from this, and in

his approach, cognitive processes are distributed between human and non-human actors. Whereby, thinking processes are not reducible to performances of an embodied cognition alone but are decentralised and rhizomatic, connected to the agency of non-human actors distributed in the environment. Cognition and culture are thought of as parts of a system that becomes a superordinate network. Thus, culture itself cannot be reduced to a collection of material things and abstract signs, but is a process itself that is located within and outside the human body (HUTCHINS 1995: 353).

To include the affordances (GIBSON 1977; GAVER 1991) of a technological object rather than the semiotic parts of the cartographic presentation only gets difficult whenever practices involve complex digital media applications. On networked platforms like the internet, users frequently meet with non-humans, like bots and software agents, driven by algorithms, and get intermingled in a heterogeneous network with these entities, oftentimes without further awareness of their appearance. Science and Technology Studies offer an object-integrated view – especially the symmetrical anthropology of the Actor-Network-Theory – which can help to open up black boxes by granting material things the initiative to change a social situation. A network approach to geomedia use can therefore overcome the dualism of form and content by acknowledging both the transformation of the sign and of the sign vehicle as part of one singular chain of translation – both become part of an integral model (THIELMANN 2008). Networks in this sense are not thought of as fixed structures but as associations of different practices including onsite and onscreen movements (LATOUR 2006: 564). The artefact is vehicle and content at the same time, and bound into a chain of inscriptions. Alongside this chain all actors, technologies, and standardisations involved in production, distribution, circulation, and consumption are affiliated to actor-networks.

Concluding from these observations I would like to propose the claim to open up evaluation processes of geomedia in order to take into account the side of the object. Cartwright & Hunter implicitly point to the influence of the artifact when they speak of the „intrinsic merit of the content" (CARTWRIGHT & HUNTER 2001: 302). Obviously situating media with their various possibilities of interaction cannot be modelled as passive and neutral mediators, because of their role in shaping our understanding of the world and, not least, because of the algorithmic turn that takes place in the digitalised production processes, leading to background noise in the form of blurry images, errors, and irritations (URICCHIO 2011). These influential factors do by no means render information transmission impossible, but open up semantically open spaces that experience closure only within the interaction with the users.

Following this, geomedia use in general, and geobrowsing in particular, can be described as a hybrid media practice. It is distributed alongside the user's movement in space – be it in geographic or media space – and the software's routines including automatic tracking and tracing as well as movements in the interface. Within an interface, geobrowsing exceeds an understanding of a static perception of cartographic material towards a dynamic interplay of tactile movement and various view controls. In order to interpret the presented contents it is not sufficient to read the depicted signs in isolation. Instead, one has to navigate through successive signposts using interactive devices. This can be explained further by following critical cartography, and by turning to a navigational approach to the understanding of maps that is fundamentally different with regard to its notion of representation (NOVEMBER et al. 2010). This puts an emphasis on a constructivist approach to map theory echoing de

Certeau and Lefebvre who consider space not as fixed, but as the outcome of a negotiation process between naturalising strategies and opposing tactics (FINK 2012). Taking the media's "molding forces" (HEPP 2012) into account here, the objects gain agency over spatial constructions and take part in the construction process. As a study by ABEND et al. (2012) has shown, users of Google Earth rely on the presented materials unhesitatingly while geobrowsing. This puts the object with its inscribed routines in a strong position particularly since users almost exclusively use the automatic routines of the search function, rather than on their own topological knowledge of the world. Therefore, it becomes evident that the underlying platform becomes a powerful entity in shaping the user's experience.

2.3   From isolated tests to situated observations

With geomedia the networked flow of both human and technological agency expands in the real world and gets connected with it – not only through social embeddedness, but also in a technical sense. At first sight this is not radically different to the function of a paper map, but personal mobile technologies expand the influence of macro actors by the possibility of discretely tracking the location of the device and tracing the movements of the actor-geomedia. And nowadays the cartographic image is just one visualisation among many. For example, while planning a route or navigating through space printing out a map remains one option, using a list of directives poses another (NOVEMBER et al. 2010). This goes along with the challenge to extend the view on map use by general questions concerning the broader institutional culture of geomedia. Since maps became ubiquitous and interwoven with many visual and non-visual media, the task for researching the usage of geographic media shifts once more from a universal, impersonalized view towards the contextual understanding integrated into a social theory perspective (FELGENHAUER & QUADE 2012).

Here, traditional methods that rely on laboratory studies and on measuring the response of anonymous participants have a problem with matching complex real world usage scenarios. A model like that of mathematical communication (SHANNON & WEAVER 1976) can reduce the complex process of map reading to different vectors that connect an expedient and a receiver via a channel. This model can get enhanced: One can add dialogical feedback loops, reconnecting the two ends, and draw big context clouds around it (FREITAG 2001). Such a model might still serve as a vivid diagram of the process but operationalisability becomes the challenge as complexity increases. The problem is immanent to the network of map use studies. Laboratories make sense because they cut connections to the outside world and produce stable settings to prove different hypotheses. But questions of social context and situatedness get out of the picture, since it is declared a negligible factor, what is secured through the quarantine of the situation. This follows the promise of the laboratory that disturbances − in the form of noise − can get eliminated. But what if noise, e.g. social dynamics and personal related bios, becomes the basic condition or even the object of study? What if spaces without noise are a utopia of laboratory studies altogether (SERRES 1987: 110ff.)?

The question is what part of map use and geomedia use is addressed. There are certainly queries that can still be answered using laboratory tests with participants working on different stimuli. But as Petchnik puts it already in 1983, "There has been a lack of serious attention to the effect of motivation in naturalistic map use and to the nature of spontaneous task performance", and she further points out the restricted practical use of complex system theoretical and cybernetic models, "In attempts to evaluate or understand function through

research, we tend to restrict our attention to individual parts or isolated components of the map-user ‚machine', or functional unit, apart from higher level meaning" (PETCHENIK 1983, 48-49). In the gradual models of visual information processing, perception is characterized as top-down and differentiated lower and higher level tasks following a computational model of vision (MARR 1982). The processing takes place on the lower level while the integration and interpretation of the information takes place on higher levels within a complex and rather uncharted collective action of several regions of the brain. The concentration on isolated parameters is a result of the demand to optimize map design (OLSON 1976; PHILLIPS 1984; DOBSON 1985). Hence, traditional map use research does not take into account the "higher level meaning" Petchenik mentions. The map producers put emphasis on the design of visual stimuli and the map had to be easy to percept and comprehend. Research into map use focussed on the perception and processing of the cartographic symbols on a sign plate and imagined the map as a blurred copy and faulty translation of the world that can get optimized by working on the translating competence. And this makes sense, because if the cartographic syntax fails on a lower level, it cannot reach and be compensated on higher levels (MACEACHREN 2004: 69). This is one reason why the emphasis laid on the first level, and the reception and grouping of single variables of stimuli. As for these lower level processes relatively simple models of cartographic communication provided a supportive basis to answer questions concerning the design of map elements. But as MACEACHREN puts it, "the higher level processes such as derivation of meaning and decision making are what maps are really about" (ibid.). Having an interest in the use of geomedia means being interested in higher level tasks, where research is confronted with a much higher degree of complexity and this generates a greater uncertainty, due to the interplay of embodied and material factors.

With regard to the ubiquity of cartographic and geographic media and their complex and multi-layered affordances for interaction, participation and reception, there is a demand for methodological realignments, since traditional research has problems with complex systems and the reductionism of functional approaches in laboratory studies reaches its limits when the embedding in a superordinate cultural context is concerned. Facing digital cartography, Cartwright & Hunter point to the importance of map evaluation in real-world scenarios, "Testing not only needs to examine the operation of the package, but also the intrinsic merit of the content as well as the additional value that users receive from both the structure of the data, and the interactions undertaken in order to 'discover' information" (CARTWRIGHT & HUNTER 2001, 302). Beginning with web mapping and in times of multi-media cartography and 3D visualisations the plea within cartography is audible to capture everyday map use *in situ*.

One reason for this shift has to do with the fact that geographic content found its way onto personalized devices and formerly passive end-users get a hold of the means to define the protocols of visualisations. In addition to this, geomedia became spanning across a variety of platforms that are not bound to a fixed place any more, but became mobile and ubiquitous. Therefore empirical research into map use is confronted with new challenges that cannot be met with standardised forms of data collection and evaluation, since the latter can only grasp a small part of the increasingly complex usage scenarios. With the entry of cartographic visualisations into the sphere of networked geomedia and the concomitant pervasiveness, the individual users and the socio-technical contexts of map use come into focus. Along with the call to leave behind the space of the laboratory goes the demand to

turn away from stimulus-response tests, and establish new methods that insist on situated and mobilized perspectives of the observant (DODGE, PERKINS & KITCHIN 2009).

2.3   Methods for studying geomedia use

The ethnological repertoire of methods presents an alternative to grasp the use of geomedia within different social contexts. These cultural approaches do not downgrade the traditional cognitive and semiotic research but are capable to answer different questions (PERKINS 2008) that are dependent on epistemological interests. Quantitative research in the form of laboratory tests had to minimize outside influences because before extracting design principles and optimizing the presentation the situation had to be ordered and measured, to subtract out results later. But to figure out the answer to questions that are concerned with the causes and effects of geomedia, the opposite is necessary. The research situation has to open up because user-sided subsidence does not become effective in the communication situation only, but reacts to prior preferences which are influenced by current situations and which get re-adjusted during the confrontation with the artifact.

Methodologically, situated actions (SUCHMAN 1999) demand a departure in method from reductionist laboratory studies towards in situ observation methods. To follow the actors – including the cultural objects – is the basic, often cited claim made in this context (LATOUR 2005). Heeding this advice, Actor-Network-Theory turns into a methodological impetus for the study of geomedia rather than a theoretical stance, more heuristic than a clarified modus operandi (DÖRING & THIELMANN 2009). In many ways, network analysis can be used for a re-orientation in map-use research towards cultural approaches, putting an emphasis on qualitative methods including participant observations. A wide variety of methods are available for such qualitative research designs, including but not restricted to visual methods, participant observations, user's self-documentation and interview techniques. In real-world scenarios video recordings proved to be valuable for gaining insights into how maps and users make sense of navigation devices during real-world tasks like tourist navigation (LAURIER & BROWN 2008). In interactive environments such as Google Earth screen capturing proved to be a good starting point since, like video recording it generates rich data that can be triangulated with verbal data and observation protocols. Furthermore it is now possible to use pattern recognition techniques in order to extract parameters like the direction of movement automatically of the visual data. For example, in a study of Google Earth usage the interaction of 27 participants was captured with screen recording software at their homes or work places and analysed with the help of a video content analysis tool. The results show that users relinquish interactivity and prefer the role of a passive recipient that gets presented pre-packaged tours over a flâneur-like encounter with the presented materials (ABEND et al. 2012). These approaches give further insights in how geomedia are interwoven with everyday practices, what they are used for, and how they are valued by users. They bring the researcher closer to the map users and address them as active agents.

Situating the research position and doing research in the wild also has a correcting function and helps avoiding technological determinism. It is often stated that a democratisation of cartography takes place that turns amateurs into producers. Especially web mapping – which is now also numbered 2.0 (GARTNER 2009) – has been associated with a major re-configuration of the traditional relationship between production and consumption turning traditional models of diffusion on its head. Critical approaches that question the degree of freedom of the ordinary user and theoretically attempt to deconstruct the Web 2.0 euphoria

(THRIFT 2006) can gain empirical support by studies of technology that take into account different perspectives alongside the whole chain of production and use of artefacts. For example, PERKINS (2007) relativises the emancipatory momentum of the community mapping projects using a contextual approach within case studies of different projects to show how participation is still bound to rather strong hierarchies that build on technological expertise.

However, this rather critical outcome is not a mandatory stance that automatically comes with a situated and object-centered perspective. Admittedly, much of the scepticism in Science and Technology Studies towards the representation and production of knowledge are the historical outcome of a relativistic programme, due to which technological artefacts and their inscriptions became understood as open for interpretation, and, in doing so, scientific authority was questioned (LATOUR & WOOLGAR 1986). For instance, Pickering speaks of the "mingling of the practice" by (laboratory) technologies and refers to the control, canalisation, and limitation of human agency by inscription devices. Here, technological agency can counteract on human agency so that the dialectic of resistance and accommodation becomes visible (PICKERING 2007). But the outcome of these reflections on technology does not always have to be a false promise. It can also lead to the emergence of new knowledge, just like the practice of geobrowsing translates into new spatial insights and discoveries (PEUQUET & KRAAK 2002).

3   Conclusion: Geomedia Literacy

The situated and object-centred approach has several implications for usage studies of geomedia in the educational context. First of all, map use is not limited to the cognitive task of map reading and interpretation, but asks for additional skills such as the handling of interactive means that accentuate egocentric perspectives and which work more like 3D computer games than traditional maps. Handling of software functions and routines becomes more important as geomedia takes on a lot of tasks like wayfinding and automatic aligning in an interface. This has implication for the design of educational materials and poses another issue regarding the origin and status of software that is used in education contexts. Commercial geomedia, such as Google Earth, paved the way for many new usage scenarios because they are much easier to use than expert systems and, like many geomedia as services, are free of charge and pre-packaged, without any further data gathering needed. But this comes at the expense that geomedia can serve as extensions of the organisations providing it, translating commercial interests into the material agency of the devices and mingle with user interactivity. The most obvious is the integration of commercial content within the geographic data displayed. With this mixing of editorial, user-generated, and commercial content in the presented search results, the translated interests are naturalised and tagged as important to other inquiries. The platform operator creates a filter bubble (PARISER 2011) that works as a shortlist for the users to choose from. By this means, many geomedia convey a world view in which the interest of a commercial company is inscribed into the software. Seen this way, geomedia becomes part of a much larger attempt to control the "Dwelling in the Web" (THIELMANN et al. 2012). Since this decentralised exercise of control counts for a variety of geomedia applications it is necessary to educate about the expanded powers of cartographic materials in the digital age. But the antecedent step includes evaluating whether the convenience and accessibility of free commercial solution prevails the downside of letting in commercial interests via the loophole of material agency.

Situating research and taking objects into account can give further insights into these novel constellations.

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