Section Editorial: Geoinformation and Society: Practising and Comprehending Geomedia

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1   Reviving Geography in the Digital Age

In the Digital Age, a wide range of everyday practices is heavily reliant on software. Everyday contexts and activities are permeated by and increasingly rely on digital media. In most instances the increasing dependence on computational programmes and processes for daily activities, such as driving a car, goes unnoticed.

The general user of the technology might not even be aware that her/his activities involve software. Many objects and activities that are taken for granted by the majority of people in the Global North are now based on software and code. Even the production and reproduction of public and private spaces involve software to a greater or lesser extent (cf. DODGE & KITCHEN 2005, 2009; DODGE, KITCHEN & ZOOK 2009). The Digital Age has seen interest in space and spatial information resurge, not least due to the convergence of localisation, entertainment and communication technologies (THIELMANN 2007, 2010; DE SOUZA E SILVA & SUTKO 2009). Devices such as laptops, tablets or smart phones provide an interactive and intuitive user experience and are becoming ever more ubiquitous (HENNIG & VOGLER 2011). As part of these general tendencies the past decades have also seen a rise in the development and use of digital geomedia, such as geobrowsers, GPS tracking devices, commercial and not-for-profit web mapping tools or mobile applications for location-based services. The change from Web 1.0 to Web 2.0 technologies (O'REILLY 2005) enabled sharing, collaboration and exchange of user-generated content. Interestingly, these technological developments lead to a 'return of geography' in an age where we consider ourselves largely emancipated from the constraining spatiality of our space- and time-dependent bodily existence. With the advent of digital geomedia, however, geography appears to return in a new guise. Digital geomedia are not merely another set of new technologies for which geography is the frame, surface or context in which they are embedded. Rather, geography must be understood as the constitutive element of digital geomedia – they have geography as their content. This is particularly obvious with respect to the new quality of the GeoWeb that enables interactive, creative and collaborative use and processing of a vast range of geoinformation.

In post-industrial societies, where participation in social and political groups and activities are increasingly digitally mediated, part of the academic and public debate revolve around the expertise and competences required to navigate and participate in such a 'Network Society' (VAN DIJK 1991, CASTELLS 1996) or 'wired society' (MARTIN 1978). Web 2.0-

based geospatial technologies are of fundamental importance for social networking and political participation (e-democracy, e-participation, e-petitions, e-government etc.) and activism.

The surge of Web 2.0-based possibilities for social networking and political participation in recent years has led the academic debate to (re)consider the knowledge and skills required to competently and effectively engage with digital geomedia in democratic decision-making processes. With GIDDENS (1990) complex technologies, (such as geomedia), can be understood as 'expert systems' which are „systems of technical accomplishment or professional expertise that organise large areas of the material and social environments in which we live today" (GIDDENS 1990, 27). They are systems that contain the knowledge of experts in a 'solidified' form (SCHULZ-SCHAEFFER 2000). That is, technologies reliably reproduce courses of events such that non-experts can use them to achieve a certain result without having to fully comprehend their technological intricacies (RAMMERT 2007).

In this context, an interesting trend can be observed: While (geospatial) technologies are becoming ever more complex, they are, paradoxically, also becoming easier or more intuitive to use. Technological devices appear (literally) as black boxes whose internal processes are hidden from the user's eye, making technological systems rather opaque to the general user (FELGENHAUER 2012). The implication of this trend for the education of (future) citizens who are confidently and competently using geospatial technologies to pursue their interests is a requirement for an educational approach that transcends the mere acquisition of technical skills (how to use a particular technology), or in GIDDENS's (1984) terms *practical consciousness*. Instead, the educational approach would need to focus on empowering people (and particularly the youth) by helping to develop their reflective and reflexive competencies; that is, their *discursive knowledge* (GIDDENS 1984).

The difference between using and understanding a technology can be described as the difference between practical and discursive consciousness – the former corresponding to non-reflective routine action, the latter referring to the ability "to put things into words" (GIDDENS 1984, 45). Importantly, it is possible to possess practical consciousness without acquiring discursive knowledge (BLUMENBERG 1981, 13). It is worth noting that discursive knowledge includes the ability to reflect on both the internal operations of a technology and the resultant external consequences of its application. With regard to geomedia this means that intuitive interfaces and user-centred graphical representations (e.g. on smart phones, in Google Maps or satellite navigation systems for cars) appeal to the practical consciousness, while having detailed knowledge about a technology and being able to verbalise it, including the wider consequences of technology use, would indicate discursive consciousness.

Such varying levels of thinking, understanding and awareness are a recurring theme in the papers that are presented in this editorial. That is, the individual contributions share a common thread that relates to the ways we are making sense of geographical information at various levels of thinking and understanding and by using various digital geomedia. Further, the papers share a concern with individual and social practices that arise from the new forms of interaction between user and (geo)medium. The following section(s) introduce(s) the individual contributions to this volume and aims to weave them together by highlighting the links between them and their common and complementary aspects.

As a common starting point serves a keynote at GI_Forum 2013 by Francis Harvey outlined in the Paper "A New Age of Discovery: The Post-GIS Era" which considers how the growing ubiquity of computing infrastructures around the world opens up potentials for a new era of discovery – specifically in global science and geographic information technologies. HARVEY suggests that the future of GIS will be a post-GIS era of discovery building on the increasing ubiquity of computing infrastructures. He highlights that post-GIS science and technologies hold key importance in facilitating connections between the physical and virtual worlds, melding them into productive arrangements and raising important questions about changing social and cultural arrangements. Regarding Science, HARVEY is speaking of a Fourth Paradigm of science, where data intensive science goes hand-in-hand with intensely collaborative large group research that considers location in fascinating new ways. In his paper, he gives insights in recent scientific activities that show how changes in the geographical organisation of our work and conduct of science have already begun to take place. The paper closes with considerations of central issues for this new age by outlining recent activities that highlight the importance of educating future professionals and scientists for the post-GIS era.

2   From Practice to Education and back again

The rather recent theoretical concept of 'Spatial Citizenship' and the emerging framework of 'education for Spatial Citizenship' pick up on these issues (GRYL & JEKEL 2012; GRYL, JEKEL & DONERT 2010). Starting from the assumption of the social embeddedness and hence non-neutrality of GIS and building on 'Critical GIS' research at the interface between (geographic) information science and (geographical) social theory, GRYL, SCHULZE & KANWISCHER's paper in this volume advances the concept of competence as applied to Spatial Citizenship. The authors productively use existing competence models and contributions from a variety of scholarly disciplines to refine their own competence model, tailor it to the concept of Spatial Citizenship and translate it into a didactically fruitful framework. GRYL and colleagues convincingly demonstrate the need for reflective and reflexive competences to enable secondary school students to become emancipated citizens who are able to effectively participate in democratic processes that involve the gathering, processing, presentation and appraisal of geospatial information.

A complementary line of thought is developed by UHLENWINKEL. Drawing on approaches from cognitive psychology and contrasting them with approaches in geography (viz CHRISTALLER), UHLENWINKEL discusses the concepts of 'spatial thinking' and 'thinking geographically'. These two models are mainly being debated by US-American and British geographers' communities. While 'spatial thinking' is largely equivalent to information processing, 'thinking geographically' is a more comprehensive notion that is best described as 'meaning-making', i.e. relating location (geospatial information) to the context and conditions in which it is embedded. UHLENWINKEL contends that current tertiary education of future teachers focuses largely on spatial thinking and neglects 'thinking geographically', resulting in a lack of competence concerning higher-level thinking. Using ROBERTS's (2003) model of various levels of thinking as a theoretical framework for her empirical research with German students who are half-way through their studies to become a teacher, she shows that only a small minority of students was able to demonstrate thinking at the level of 'application' and 'analysis'; that is, geographical thinking. Significantly, none of

the students showed the higher-level thinking competence of 'synthesis' which would involve appropriate integration of various kinds of information from multiple sources to develop a conceptual idea of the topic in question. UHLENWINKEL's study did not aim to evaluate teaching and learning processes, but assessed the actual competences of students regardless of how these competences were acquired. UHLENWINKEL rates the results of her study as rather discouraging (or in her own words: "frustrating"), particularly given that the sample consisted of students who were half-way through their studies and would soon be teaching geography in schools. UHLENWINKEL's contribution, thus, urges us to rethink the competences to be developed by both future teachers and their students. She cautions against simplistic approaches in geographical education and, like GRYL and colleagues, stresses the need for reflective and reflexive competences to be developed. That is, both UHLENWINKEL and GRYL and co-workers identify discursive consciousness as essential for the competent and literally 'meaningful' use of geomedia. Both papers make the point that this requires educational approaches that enable students to transcend the mere routine-like reproduction of learning content (i.e. practical consciousness). Instead, learners should be enabled to develop higher levels of (geographical) thinking that will empower them to comprehend and assess complex and multi-dimensional issues. Embarking on such educational challenges will likely involve changing trajectories of teaching and learning.

The problem of building up competences in geographical thinking as well as competences concerning the use of digital geomedia is also the topic of VOGLER & HENNIG's contribution. Their empirical work, however, focuses on a different age group. Their paper presents the results of a pilot course title "Geomedia 55+" with 19 participants aged 55-72.

While schools are often introducing children to geomedia from an early age, similar opportunities for adults are still insufficiently developed. VOGLER & HENNIG thus help to fill this gap by aiming to build up adults' digital geomedia literacy. Starting from research questions around the specificities of adult education in theory and practice, the design of the empirical part of their research is attentive to the characteristics and requirements of people who form a very heterogeneous group as far as their prior work experience and education are concerned. The wide variety of participants' backgrounds translates into significant differences in prior knowledge or information and communication technologies in general and digital geomedia in particular, in their motivation to participate and in the particular barriers to a successful completion of the course encountered by different participants. However, VOGLER & HENNIG were able to meet these challenges by deploying a variety of educational methods ranging from lectures to exercises and from face-to-face sessions to self-guided study. Apart from teaching technical skills, the course also involved a critical assessment of political issues surrounding digital geomedia, their use and abuse, as well as a reflection on the work and accomplishments at the end of the course. VOGLER & HENNIG's success is confirmed by very low drop-out rates, unanimously positive feedback and participants' interest in follow-up courses. In addition, participants considered their enhanced geomedia literacy useful and important, and the course has further increased their intrinsic motivation to learn about geomedia. These outcomes hint at a vital aspect of (adult) education: the ability to maintain and further improve learning beyond the length of any teaching or research intervention.

While UHLENWINKEL as well as VOGLER & HENNIG highlighted some of the empirical issues concerning the "meaning-making" (UHLENWINKEL in this volume) of geographical information, GRYL and colleagues advanced the theoretical framing of competences re-

quired to effectively engage with digital geomedia in everyday life contexts, particularly in democratic decision-making processes. Complementary to these contributions, CARLOS & GRYL invite us to reflect on the conceptual overlaps of Critical Thinking and Spatial Citizenship as well as on the education-related aspects that Critical Thinking can contribute to Spatial Citizenship. Based on an account of the theoretical underpinnings of 'education for Spatial Citizenship' and Critical Thinking in educational contexts, CARLOS & GRYL offer a systematic review of the literature concerning the theoretical links between the two concepts, and in doing so, they help fill a research gap that has only recently become apparent. Their results indicate that incorporating certain aspects of Critical Thinking theory in the concept of Spatial Citizenship may be of substantial benefit as this will also help refine the emerging notion of 'education for Spatial Citizenship'. CARLOS & GRYL arrange their content analysis of the relevant literature around two categories that arise from their research questions. The first category concerns theoretical overlaps (in the Critical Thinking, spatial domain and citizenship domain); the second category concerns potentially useful conceptual contributions of Critical Thinking to Spatial Citizenship (intersection with, extension of or incongruent with Spatial Citizenship). The analysis reveals that further theoretical refinement is in order where terms are ill-defined, fuzzy and/or only incompletely developed. Further research is needed to establish whether there are actual theoretical overlaps (common theoretical foundations), or whether what appears to be an overlap is actually a loose or incoherent use of terms. This lack of clarity notwithstanding, CARLOS & GRYL point to the field-tested methods of Critical Thinking that may help advance the emergent concept of 'education for Spatial Citizenship'. Some of these methods can be readily integrated into a framework for Spatial Citizenship education, while others may require substantial adaptation. In addition, CARLOS & GRYL identify further research needs concerning the potential for cross-fertilization of Critical Thinking and Spatial Citizenship education in terms of practical applications in learning environments.

3   Can Learning be Fun? The Playful Appropriation of Space

In their quest for stimulating and productive teaching and learning methods, CARLOS & GRYL share some common ground with ODOBAŠIĆ, MEDAK & MILER. In a study on the gamification of geographic data collection, ODOBAŠIĆ and co-workers outline the strategies employed and outcomes expected when learning experiences are transformed into gaming experiences. Drawing on ZICHERMANN & CUNNINGHAM (2011), ODOBAŠIĆ and colleagues define gamification as the use of game thinking and game mechanics in order to engage users in problem-solving. This is achieved through the use of a variety of game design elements (especially reward systems) that appeal to the emotional, affective and playful aspects of participants' personalities. The aim of gamification is an expansion of the time spent on the learning exercise (the game) and a deeper immersion into this exercise. If successful, gamification results in the user spending much more time and resources on the game than s/he had initially planned (and very likely more than s/he would have put into a non-gamified learning exercise).

Since the course of location-based games depends on the players' location, these games require some kind of localisation technology, for example GPS, WiFi, Near Field Communication or Bluetooth. The distinction between location-based games and location-based social network games becomes increasingly blurred, an example being Foursquare.

ODOBAŠIĆ and colleagues also highlight that it is very important to instil users with a sense of agency in order to ensure their continued playing and hence geographic data collection. For this, users need to feel empowered; they need to see their actions as meaningful and as making a difference to the overall outcome. In this sense, gamification may be considered a tightrope walk. On the one hand, it offers an engaging and stimulating learning experience. On the other hand, it might be argued that it uses trivial or superficial effects and rewards to 'manipulate' the user.

The thoughts by ODOBAŠIĆ and co-workers on the issues surrounding a possible difference between the users' perceived and actual agency resonate with ABEND's reflections on this matter. Drawing on LATOUR's actor-network theory and its notion of a symmetrical anthro-pology, ABEND shows that the map is no longer a neutral mediator but a space of action in its own right – a space which enables certain actions and modes of perception but precludes others. With the advent of geobrowsers, the map is no longer a flat representation. Instead, the digital format allows panning, zooming, changing colours and varying the perspective by turning the map upside down. ABEND argues that the map is thus no longer a static and 'given' representation, provided by cartographic experts. Rather, map use is becoming increasingly interactive and leaves room for creativity on the part of the user. There is a distinct playfulness, emergence and interactivity here that traditional map use research is unable to capture/adequately investigate due to its traditional conceptualisation of map use as a passive reading activity. ABEND acknowledges, however, that the act of (or actions involved in) mapping has shifted its focus from providing a detailed and 'true' *representation* of the world 'as it is' towards offering tools that enable the user to become the creator of her/his own *visualisation*. Such an empowerment of the previously passive consumer of a scientific product then raises new issues. In their paper, GRYL and colleagues have pointed to the challenges arising from the ubiquity and social embeddedness of digital geomedia. For the youth to be able to participate as emancipated citizens in democratic decision-making processes, it requires a comprehensive citizenship education that includes the competent use of digital geomedia, the mature appropriation of space and the higher-level "meaning-making" of geographical information (UHLENWINKEL in this volume).

Based on the differences between the use of a traditional map and the use of digital geomedia, ABEND argues for a new research perspective that takes into account the social context and embeddedness of map use (or rather map creation in his case) and the material agency of the medium. To this end, he suggests drawing on the actor-network theory as well as the concept of distributed cognition. These theoretical lenses, ABEND argues, are more appropriate to the new realities of digitally mediated geographical visualisation practices because they acknowledge the agency of material objects and take account of the distribution of cognitive processes between human and non-human actors.

4 Practising Citizenship as Applied Geomedia Competence

Similarly to ABEND, HARVEY and MISCIONE also argue for a research perspective that takes account of the new realities of multi-purpose and open-ended information infrastructures and their qualitative differences to the traditional stand-alone and task-oriented information infrastructures. They present the 'practice lens' as a theoretical approach for enquiring into the growing role of such information infrastructures and the associated social practices that

contribute to increasingly connected global citizenships. Such practices are characterised by their ever-changing, dynamic nature that results in loose configurations of activities and ephemeral groups and networks.

The study by STEINMANN, HÄUSLER, KLETTNER, SCHMIDT & LIN also picks up on the issue of participation of different user groups in online platforms. In their paper, STEINMANN and colleagues investigate the reasons for and implications of differences in the activity of male and female users in terms of contributing user-generated content (UGC). STEINMANN and colleagues distinguish three types of platforms based on the kind of user-generated content they use: spatially explicit, spatially implicit and non-spatial UGC. The first group is represented by OpenStreetMap and Google Map Maker, the second by Foursquare and Panoramio and the third by Facebook and Wikipedia.

STEINMANN and colleagues base their study on a literature review which suggests that women are equally represented and likely more active than men on *social* UGC platforms (e.g. Facebook), they are underrepresented on *spatially explicit* UGC platforms (e.g. OpenStreetMap). That is, women are less likely to contribute content in the form of Volunteered Geographic Information which is a subset of UGC (GOODCHILD 2007). For their analysis of motivational aspects, the kinds of action and interaction and their outcome, STEINMANN and colleagues deploy the framework developed by BUDHATHOKI, NEDOVIĆ-BUDIĆ & BRUCE (2010).

Results indicate that UGC platforms are not generally suffering from an imbalance in the proportion of the contributions made by male and female users. Comparing all three types of UGC platforms shows no association between the proportion of female contributors and the extent to which the platform relies on geospatial content. Concerning the factors that may influence the proportion of males and females participating, STEINMANN and colleagues suggests that females are more motivated to actively contributing to UGC platforms with a social element (viz Foursquare and Facebook). In addition, they identify communication and information sharing mechanisms as having an influence on the gender balance of contributors: Platforms with stringent rules for contributing have a relatively high proportion of female users; this is also true for platforms that allow for control of communication (e.g. through deleting or disabling comments or limiting access to comments and posts to particular groups of people). Concerning the opportunities for contributing to the various platforms, the analysis by STEINMANN and colleagues reveals that those platforms which extensively rely on sharing personal information and interacting with the community (Facebook and Foursquare) show the most balanced proportions of male and female contributors. In contrast, those platforms with limited (Panoramio) or no options of commenting on other people's contributions (OpenStreetMap, Google Map Maker and Wikipedia) have the lowest number of female contributors. The gender dimension in UGC is very much a nascent field of research, and the paper by STEINMANN and colleagues will likely help advance the discussion in this area.

Issues surrounding individual and social practices in dealing with geomedia is a common thread of the above three papers and the last one in this section. In their contribution, FERBER & JEKEL investigate the intangible infrastructures of a city. Drawing on MARTINA LÖW's concept of the intrinsic logic of cities, FERBER & JEKEL examine the processes involved in attributing meaning to particular spaces in a city. The authors discuss how various forms of practices give meaning to particular places, subjects and networks which

constitute city spaces. According to FERBER & JEKEL, such immaterial aspects of individual spatial perception and the geographies of social networks can be represented in a *multi-layer map.* This type of visualisation maps individual paths and social relations within city space. The required spatial input data can be derived, for example, from Location Based Social Networks (LBSM). FERBER & JEKEL's concept of multi-layer mapping is able to show how urban geographies of lay people may contribute to a scientific understanding of urban spaces in the Digital Age – comparable to the concept of "citizen sensors" (GOOD-CHILD 2007) – and how, in turn, advanced cartography may increase public spatial understanding. This kind of synthesis could also be a valuable contribution to reflect on the possibilities of integrating lay knowledge into geomedia education.

5   Summary and Conclusion

In the wake of the increasing popularity of digital geomedia geography and geographical matters experienced a resurgence of interest. Technological advancements in the field of geospatial technology as well as digital technologies more generally have led to technological systems of ever-greater complexity yet high user-friendliness. At first sight, this appears to be a development that is to be welcomed as it enables an intuitive and conflict-free routine use of such technologies. The absence of disruptions and disturbances, however, is not conducive to achieving reflective and reflexive learning (JAPP 1992, HALFMANN 2011).

As the papers by GRYL and colleagues, UHLENWINKEL, VOGLER & HENNIG and ABEND presented in this editorial have shown, an education that enables students to develop their discursive consciousness, including the ability to reflect on both the internal operations of a technology and the resultant external consequences of its application, is crucial for their developing higher-level thinking skills and becoming emancipated citizens. Some theoretical reflections that tie these considerations to the concepts of Critical Thinking and Spatial Citizenship education were offered by CARLOS & GRYL. In addition, FERBER & JEKEL presented an approach of mapping and visualising the attribution of meaning to city spaces which may usefully complement further reflections on the possibilities of integrating lay knowledge into geomedia education.

The importance of research being attentive to individual and social (online and offline) practices and the role of (distributed) agency has been highlighted in the contributions by ABEND, HARVEY & MISCIONE as well as to a certain extent by STEINMANN and colleagues.

Digital geomedia are, however, not only 'serious' tools with a political dimension to their use (and potential abuse), but also technologies that feature distinct playful, emotional and affective elements which may be productively integrated into educational contexts (cf. ABEND and ODOBAŠIĆ and colleagues).

It can be concluded that most of the papers presented here are concerned with questions around the cognitive and communicative modes that are employed to approach, handle and reflect upon geoinformation. A central topic and common thread were the different levels of thinking and awareness concerning the constitution of geoinformation and digital geomedia: aspects of (routine) skills, (technical) knowledge, and critical discourse. In

addition, many of the papers reflected on both the importance of playful engagement as well as an ambitious political discourse for successful geomedia education.

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