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RESEARCH ARTICLE

New Visualities of Space and Place: Mapping Theories, Concepts and Methodology of Visual Communication Research on Locative Media and Geomedia

Cornelia Brantner

Institut für Wissenskommunikation und angewandte Forschung, Vienna, AT

brantner@iwaf.at

The integration of geolocative data and locative photography generates a new way of seeing: what is called 'emplaced visuality'. This article explores the features and the research advancements in the direction of the visual aspects of locative media and geomedia to expand on the understanding of what appears to be a new visual regime. To do this, the text explores the developments of locative media and geomedia to link them to a series of disciplinary 'turns' that bridge areas of interdisciplinary thought within the knowledge ecosystem: from the spatial and mobility turns to the (visual) algorithmic turn. The paper points to current research strands in the field as a way of grasping the visual regime emerging from adding location to imaging. Exploring these features assists in mapping the expanding field of geomedia and visuality while also opening more opportunities for further research.

Keywords: locative media; geomedia; geovisualisation; emplaced visuality; visual algorithmic turn; visual regime

1 Introduction: Mediatisation, visualisation and space

In times of 'networked locality' (Gordon & de Souza e Silva, 2011), everything is emplaced and locatable, and our everyday digital communication confronts us with unprecedented numbers of images of place (Dodge, 2014). Communication with digital devices happens *in* places, *on* places and *across* places: we tag and share locations on holiday pictures, on *Instagram* or while contributing to collective maps. New communication technologies and practices create many-faceted entanglements of communication and place (Adams & Jansson, 2012). Textures and structures of place and space overlap when GPS- and WLAN-interlinked data connect with geographical databanks. The formed hybrid spatial structure – partly mobile phone, partly GPS satellite, partly internet, partly remote databank – is visible in geomedia (Adams & Jansson, 2012). The circulation system, including devices and data flows, has a symbolic significance as it is inscribed in social practice; users, however, integrate these practices in

their everyday life, without consciously taking notice of them; and devices, data and infrastructures, as well as spaces, places and imaging, turn invisible as they become mundane. Such unawareness of *mundanised* geographic practices brings notions such as 'ubiquitous computing' (Dourish & Bell, 2011) or 'ubiquitous photography' (Hand, 2016) to the fore, at least as reminders that image production, mobile devices and location happen within our everyday media practice.

The media thus should no longer be considered outside society; instead they are integrated in everyday social activities (Hepp & Krotz, 2014). This social-constructivist tradition of mediatisation research allows a holistic comprehension of media-related social phenomena and cultural processes within the context of spatial practices. Thus, locative media practices, such as digital mapping, can be understood as mediatisation processes (Rodríguez-Amat & Brantner, 2016). Visual communication plays an essential role in the mediatisation of spatiality or the mediatisation of the sense of space (Schilling & Vietze, 2013) to the point that the ubiquitous locative, geomedia and augmented reality applications set a *new visual regime* (Rubinstein, 2013; Uricchio, 2011).

This article asks about the specific power features of this regime of visuality, particularly taking into consideration those visual aspects derived from these new geolocative features. Visual culture, Mitchell (2002, 91) reminds us, 'is less concerned with the meaning of images than with their lives and loves'. Hence, analyses should not be limited to the study of the visual representations of place but extend to other aspects, such as production – and everyday usage practices or structures of media –and place governance (Adams & Jansson, 2012; Brantner & Rodríguez-Amat, 2016; Rodríguez-Amat & Brantner, 2016). To do so, this article initiates a theoretical and interdisciplinary discussion that feeds from and into visual communication studies. The text explores the beginnings and developments of locative media and geomedia (section 2) to link them finally to a series of disciplinary 'turns' that transform knowledge ecosystems by opening them up to areas of interdisciplinarity: from the *spatial* and *mobility* turns and the *media(l)* and *digital* turns to the *iconic* and to the *(visual) algorithmic* turns (section 3). These new areas of discussion and research emerge with a new set of power conditions that define a geomedia regime (section 4) and a new set of features for the visual regime. With the use of five examples (section 5), this paper points to research strands in the field and identifies features which, by adding location to imaging, establish a new regime of knowledge and vision. The section starts with three strands of analysis of spatial representations, then it deals with the utilisation of maps for data collection, exploration and presentation in visual research. Finally, we outline the concept of 'emplaced visuality' derived from the analysis of practices of locative smartphone photography.

2 Fundamentals of locative media and geomedia

The term *locative media* derives from two origins: Ben Russell's *Headmap Manifesto* (1999), delineating the socio-technical potentials of location-aware devices and stating that invisible, mobile, networked computers are recolonising the real world (de Souza e Silva & Frith, 2010; Zeffiro, 2012); and Karlis Kalnins's coin at the *Art + Communication Festival* in Riga in 2003 (Thielmann, 2010; Zeffiro, 2012). Moreover, psychogeography, the situationists and critical cartography are deemed antecedents of locative media (Jethani & Leorke, 2013; Zeffiro, 2012). 'After all, the innocent symbolic roots of the term locative media were to be found in an expressive practice that had not yet entered the halls of commercial exploitation' (Rodríguez-Amat & Brantner, 2016, 1031).[1] Indeed, the use of locative media remained limited to demos and art-technology festivals until 2008, when Apple introduced the GPS-enabled iPhone. 'Paradoxically, the mass realization of locative media seems to have taken the wind out of its sails as an art form' (Cornell & Varnelis, 2011, 13). Thus, Brantner & Rodríguez-Amat (2016)

conclude that the artistic and experimental possibilities of multiple representations of the world are now channelled by market forces and commercial logic, enticing further analyses around power, governance and the political economy of locative media.

Whereas the literature distinguishes between notions of locative media and geomedia, their concepts and practices tend to merge. The former refers more to 'technologies of positioning' (Frith, 2017, 538), including the hardware equipped with location-identifying technology (e.g. GPS, cellular triangulation, Wi-Fi), whereas *geomedia* comprises 'locative media + mediated localities' (Thielmann, 2010, 5), including the geoweb and its (lay)cartographic software (Döring & Thielmann, 2009; Lapenta, 2011).

In terms of implementation, five distinguishable strands can be sorted (Brantner, 2018): (1) map services, (2) user-generated digital maps, (3) location-based services (LBS), (4) location-based augmented reality (AR) applications and (5) social media with location-based features.

The *map services* (1) include *Google Earth/Maps, Bing Maps* and the open-source *OpenStreetMap*. These maps can render users in to so-called 'neogeographers' (Goodchild, 2009), provided that they contribute voluntarily with geographical contents (VGI), be it texts, photos or videos, distributed later on digital maps, LBS or AR applications. These *user-generated interactive maps* (2)—also called map mashups (Goodchild, 2009), crowdmaps (Rodríguez-Amat & Brantner, 2016) or participatory geographic information systems (PGIS)—work as much for social movements and activists, art projects and public participatory projects on community activity (e.g. http://www.ppgis.net/) as for (semi-)public platforms (such as citysourced.com; or *Geograph*® Britain and Ireland) or for crisis mapping, to name but a few of these user-groups.

LBS (3) are an implementation of locative media which are typically commercial applications, financed through advertising, registration fees or venture capital (de Souza e Silva & Frith, 2010). Locative mobile social networks (LMSN), such as Foursquare's *Swarm*, allow the sharing of location with 'friends'. As a specific type of LBS, they not only provide users with spatial information but also permit the display of their physical location on a map to locate each other and to communicate or to 'play' together (de Souza e Silva & Frith, 2010). Other LBS are search and recommendation apps, such as *Yelp* or *Foursquare*, self-tracking apps, such as *RunKeeper*, dating apps, such as *Tinder* or *Lovoo*, or mobile news apps. In 2018 the *Google Maps* app added an 'explore' tab that allows users to learn more about their surroundings as well as a 'for you' option for personalised recommendations, updates and follows. Facebook also integrated LBS, turning itself into a company with extensive capacities for geo-demographical profiling and enhancing its position on local advertising markets (Wilken, 2014a). Furthermore, LBS include location-based augmented reality-apps (4), which use browsers such as *Wikitude* or *Layar*. With AR-apps the image of the 'real' surrounding is graphically augmented with information: the 'virtual' enriches the physical environment (Liao & Humphreys, 2015).

Beyond that, social media, which are not per se location-based, also allow the utilisation of 'check-in' functions, such as with Facebook, Twitter and Instagram (5). A further connection to geographical information ensues through the sharing of geo-referenced photos and videos. This can happen through the activation of location services (automatic geotagging allows sending the coordinates of one's whereabouts) or through active manual geo-referencing by the user (by naming the location in text or by the active allocation of specific place coordinates, calculated by the platforms [such as Flickr or Instagram]).

These are only a few examples of locative media and geomedia applications. Through their expansion grows not only the number of the geographical information revealed actively and voluntarily by the users (VGI) but also those disclosed involuntarily or inadvertently, which are called non-volunteered geographic information (Weiser & Abdalla, 2013). VGI is also

differentiated from ambient geospatial information (Stefanidis et al., 2013). The latter refers to social media posts marked with geo-information (e.g. through geotagging or through location information added to postings or in the profile) without the initial intention of collecting geographical information in the neogeographical sense. All these types of applications of locative and geomedia open up debates at multiple levels but also generate epistemological disturbance in the disciplinary structures of science. A symptom of these debates can be found in the proliferation of disciplinary turns.

3 Disciplinary 'turns' and the visual algorithmic turn

Multiple disciplines have turned their attention towards locative media and geomedia, with anthologies and authors (e.g. Adams & Jansson, 2012; Döring & Thielmann, 2009; Wilken & Goggin, 2015) pursuing the only recently-initiated surmounting of certain disciplinary boundaries.

The awareness that media and space are in close interaction has been highlighted through such notions as 'communicative spaces' (Rodríguez-Amat & Brantner, 2016) or 'MediaSpace' (Couldry & McCarthy, 2004). The latter defines an interdisciplinary dialectical concept that opened out a holistic study ranging from media representations of space to the analysis of 'how media-caused entanglements of scale are variously experienced and understood in particular places' (Couldry & McCarthy, 2004, 8). In this same vein, a *spatial turn* and its follow-up *mobility turn* (Urry, 2007; Sheller, 2017) crossed into the humanities and social sciences, particularly hitting media- and communication studies (Adams & Jansson, 2012; Döring & Thielmann, 2009; Jansson, 2007; Thielmann, 2010). This *spatial turn* involved considering spatial factors in relation to cultural and social life in a large spectrum of disciplines (McKinnon, 2011); for some, it cannot even be conceived of without the *material turn* (Jansson, 2007). This implies that locative media are not only forms of cultural practice but also require considerations in relation to material conditions such as transport, mobility and locality. Geographers also give credence to a *cultural, communicational* or *media(l) turn* (Adams & Jansson, 2012; Döring & Thielmann, 2009; Thielmann, 2010) and a *digital turn* (Ash et al., 2018). Correspondingly, Döring and Thielmann (2009) argue for an interdisciplinary media geography similar to Adams and Jansson (2012; Jansson, 2007), who plead for communication geography.

In spite of stating later that 'there are no visual media' (Mitchell, 2002, 91) because media are never purely visual (or textual) but multimodal/mixed, Mitchell (1995) pointed to an *iconic*, *visual* or *pictorial* turn that aligned with Lefebvre's 'logic of visualisation' (1991, 96) and referred to the increasing importance of images and visuality in contemporary societies.

Finally, against the background of increasingly widespread geomedia and augmented reality applications and their algorithmic configuration, Uricchio (2011; see also Lapenta, 2011, 2012; Rubinstein & Sluis, 2013) declared the existence of a (*visual*) *algorithmic turn* and highlighted its implication for images using the examples of AR applications (e.g. *Layar* or *Wikitude*) and the geomedia application *Photosynth*.[2] *Photosynth* is a panorama- and 3D-modeling software, which is based on *Bing Maps* and geotagged Flickr photographs. It allows the merging of different photos of objects. The software works (like *Google Earth/Street View*) by 'stitching' using algorithms that recognise contours, objects, camera positions and angle. The panoramas and 3D-pictures created with *Photosynth* can be integrated into *Bing Maps* just like the photos of interiors or objects situated offside. In his approach, Uricchio (2011) starts from an algorithmic reconfiguration of the relationships between the seeing subject and the observed object in the nascent visual regime. *Photosynth* and similar geomedia applications, such as *Google Photo Sphere*, allow movement *within* the image, for example, utilising the navigation buttons. On the other hand, AR applications enable images *in* motion. The movement

is situated in the physical world; thereby, the perspective is limited to the seeing subjects. 'Mediated looking' through the camera of the mobile device is not only 'an algorithmically enabled navigational act' but also makes impossible 'an innocent gaze: the act of gazing and the views consequently seen are transformed into a process of signification as images are laden with particular meanings' (Uricchio, 2011, 32). The representational linking of a sign (image of a place) and place (image location), respectively code and space, that is visible on maps, is crucial for the mediality of geomedia (Thielmann, 2010).

The modern world is extensively a *seen* phenomenon, and, with AR, '*what* we see, and even *how* we see it' (Uricchio, 2011, 33) is not only culturally constructed in the traditional sense but also determined by the algorithms. They reorganise visual information, serve up object recognition, link objects with databanks and visualise objects.

Algorithms penetrate the deepest structures of locative media, too. They connect data locations with remote databases, allow movement through places and between places and simultaneously provide spatial and non-spatial information (Adams & Jansson, 2012). This convergence of geosphere, namely the material physical world, and of the infosphere, the symbolic representations of the physical world, creates and shapes a 'mediated space' (Lapenta, 2011). The convergence of locative media and 'mediated localities' (Thielmann, 2010) invites a reassessment of location (Lapenta, 2011). The rise of locative media and geomedia strengthens their formative influence on representation, perception and awareness of place and space. Hence, it is relevant to address issues such as how people's imaginations of space change through digital geomedia.

4 Geomedia as social constructs and their implications for power structures

Locative media enable users to assign meaning to places (Frith & Kalin, 2016) and to create place attachment (Schwartz, 2015) by 'checking in' and appending geotagged information to a location which other people in turn can access with their devices while at the location: 'No matter how mobile our everyday lives have become, we continue to value places, remember what they mean to us, identify ourselves with them, and communicate our identities through them' (Özkul, 2015, 112). Providing location information that can be incorporated to artefacts that users create and share about their place experiences changes the value and meaning of places. Thus, through both receiving and sharing locational information, our perceptions of place are altered. This enhances the awareness of multiple meanings of place because users are able to explore aspects of a city that are not physically visible (Özkul, 2015). Location-based mobile practices thereby serve to facilitate identity construction, memory making and the creation of place attachment (Frith & Kalin, 2016; Schwartz, 2015), whereby images are of particular importance (Hand, 2016; Pink, 2011). In research terms this involves tackling the plural fragmented perceptions of space shaped by subjective experiences and the diversity of visual narrations from 'producers'.

Also, the integration of location and information matters because it generates an environment that transcends pure representations of spatial phenomena: physical space becomes an interface for information and information turns into an interface for physical space (de Souza e Silva & Sutko, 2011). Thereby, locative media connect people and link people with places, and thus, *hybrid spaces* arise: 'virtual' *and* physical spaces, in which the boundaries between 'online' and 'offline' blur. In this sense, for an adequate understanding of the practices, it is essential to overcome some predominant apriorisms. On one hand, the dichotomisation into 'real' and 'virtual' spaces becomes just as obsolete as a purely physical-geographical approach, which conceives the maps only as representations. On the other hand, a simple technological comprehension of the digital geomedial practices, which focuses only on devices and interfaces, would also be an oversimplification (Brantner & Rodríguez-Amat, 2016; Rodríguez-Amat

& Brantner, 2016). The holistic approach required needs to attend to the complex circuit of digital devices and information flows and the architectural space as a complex interface.

Geomedia are equally sources for change as they are agents of reproduction. They enable the emergence of new knowledge politics; 'individuals and institutions leverage digital spatial data and spatial technologies in negotiating social, political and economic processes' (Elwood & Leszczynski, 2013, 545). They do this under three conditions: first, maps are not neutral; second, commodified geomedia belong to economic circuits; and third, geomedia map us and our everyday lives.

On geomedia spaces become visible and comprehensible, and due to their visuality, geomedia are trusted and are considered credible (Dodge, 2014). Nonetheless, maps and technologies are social constructs (Crampton, 2001) that are by no means neutral and set limits and conditions for contents, while imposing particular understandings (Rodríguez-Amat & Brantner, 2016). Visualisation not only makes visible but also limits the possibilities of interpretation: for nobody can see what is not shown. Correspondingly, maps should be considered as intentional representations of space, 'as social agents with political implications' (Dodge, 2014, 299), and, following Lefebvre's (1991) analysis of the cultural process of space production, spaces themselves ought to be considered as social constructs. Hence, it is imperative to consider the politics *behind* digital maps, the politics *within* maps and the politics *through* maps.

Second, geomedia are commodities within an economic circuit of profit. This means that the information on geomedia, as Lapenta (2011) points out, is not only connected with local referents, which is the physical space and the body of the users; also, the users themselves and the surrounding space are transformed in information (datafied), and the emerging data (texts, pictures, videos and so on) can be commercialised. It is therefore essential to question the political economy of the geoweb and geosocial media and to ask who, and in what manner, accumulates capital and profit (Poorthuis et al., 2016).

Finally, geomedia are about ourselves and our everyday lives. Geographical information, whether intentionally or unintentionally revealed, can, in turn, be analysed by others, be they scientists, government agencies, private companies or the platform providers themselves. It is clear that the obtained location data also involve a high potential for abuse, likewise entailing questions about privacy, security and surveillance as well as questions about research ethics (e.g. Poorthuis et al., 2016; Stefanidis et al., 2013; Weiser & Abdalla, 2013). The knowledge obtained through and in relation to society and geomedia is thus as challenging in terms of new knowledge as it is concerning in terms of ethics and the protection of privacy. Furthermore, the locative data from social media studies are not fully reliable: for example, tweeters using geotagging are not representative of Twitter users (only about 1–3% of Tweets are geotagged), nor is Twitter representative of the population (Malik et al., 2015). Studies discussing the geographical bias of Big Data recognise an overrepresentation of wealthy places and urban inhabitants (Poorthuis et al., 2016). Alongside other factors, this is due to the uneven development of infrastructure, which allows (or impedes) communication flows in the first place (Adams & Jansson, 2012; Brantner & Rodríguez-Amat, 2016).

These three aspects of this challenging geomedia regime are a reminder that the ecosystem of data, users and the possibility of collecting and analysing them requires debates and decisions around its governance as that directly involves power. Indeed, a warning must be issued here against the generalisation of data.

Geomedia can support social change and, as a result, break conventions (Dodge, 2014; Liao & Humphreys, 2015; Zeffiro, 2012) but they are also agents of the normalisation of power relations because they reproduce the dominant social order and practices, presented as reasonable and natural (Bourdieu, 1989). Thereby, locative media and geomedia are and represent

spaces of power and power discourses (Hoelzl & Marie, 2016; Zeffiro, 2012). On the structural level, media and technology governance as well as the governance of public spaces guide information flows (Brantner & Rodríguez-Amat, 2016; Rodríguez-Amat & Brantner, 2016).

The power implications of geomedia have already been explored in the literature, but how they are related to the visual regime is not clear. A review of current research brings more light to the matter.

5 Visual aspects of locative media and geomedia: From geovisualisation to the analysis of visual practices

There are several research approaches applied to the analysis of visual aspects of locative media and geomedia (Brantner, 2018). The following paragraphs exemplify five of these approaches: the first three deal with the geovisualisation of metadata, the fourth concerns the application of and research on interactive participatory maps (PGIS) and the fifth and final one deals with the concept of 'emplaced visuality'.

5.1 Geovisualisation and geovisual analytics

The terms geovisualisation and geovisual analytics derive from geography and related disciplines. Geovisualisation covers the 'explicitly visual presentation of phenomena, contexts and problems with geographic/spatial referents' (Elwood & Leszczynski, 2013, 547). Geovisualisation is a subfield of visual analytics and further developed into geovisual analytics. This consequently integrates approaches from cartography and geographic information sciences with those of visual analytics.

Maps are central to the methods of geovisual analytics. They should not be understood only as pure representation but also as an interface and 'an external cognitive artefact that connects the human reasoning with computation methods' (MacEachren, 2013, 167). Typical applications employ dynamically interlinked views, which facilitate the observation of geographical variations in phenomena or entities of interest (Nelson et al., 2015). Geovisual analytics allow spatiotemporal analyses as they overcome the conceptual separation of time and space prevalent in geovisualisation (Nelson et al., 2015).

This approach is followed, for instance, in the projects *SensePlace2*[3] and *SPoTvis* (spatial patterns of the visualisation of Tweets) from the GeoVISTA Center. Both applications use Twitter messages and permit their search by keywords and their analysis from the point of view of origin (the place from which a geotagged tweet is sent), destination (the place to which the tweet refers) and time points (determined through timestamps) and their visualisation on interactive maps. For example, tweets about a flood disaster can be visualised on the interactive *SensePlace2* map, and temporal sequences can be traced directly after the catastrophe or during the ongoing relief efforts (MacEachren, 2013; Nelson et al., 2015). Such applications also find practical implementation in different crowdmapping projects. In this regard, the PGIS by the *Crisis Mappers* network (http://crisismappers.net/) provide the possibility of collecting and visualising information about affected areas in the case of disasters.

5.2 Visualisation of geo-data exemplified by Twitter

Malik et al. (2015) and Wilken (2014b) provide reviews of studies which analyse geotagged tweets (in the sense of ambient geospatial information). These reviews show that various research interests can be covered using these approaches, from analyses of mobility patterns, urban life, network dynamics and information flows to the prediction of epidemics. These studies can be methodically allocated either to geovisualisation, when the available geographical data are visualised on maps, or to geovisual analytics, when concomitantly time components are also considered.

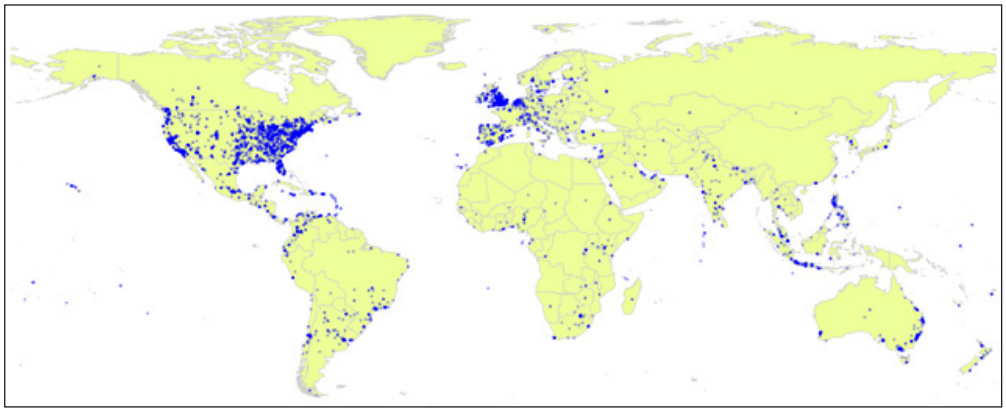

Figure 1: Visualisation of geographic distribution of geotagged tweets about climate change (0.9% from 897.306 tweets) posted in 2014. Python scripts were used to gather tweets (from Twitter Decahose) and to extract metadata. The coordinates extracted from geotagged tweets were visualised on the world map with the open-source software QGIS (Brantner & Pfeffer, 2016).

The visualisation of geotagged tweets can also be helpfully inserted into professional practice, as in disaster situations (see above) or in the case of crowd maps used for demonstrations (Rodríguez-Amat & Brantner, 2016). In disaster situations, emergency services can transmit geotagged tweets with essential information, but they can also react to geotagged tweets from the affected region—extracting, assessing and visualising geographical information from tweet texts to obtain a picture of the situation (Bruns & Burgess, 2014).

Figure 1 shows the visualisation of geotagged tweets on the issue of climate change and global warming on a world map. The visualisation of the geographic distribution points out the fact that an increased density of tweets is recorded in regions with a higher population density. However, in coastal areas, particularly affected by the effects of climate change, the occurrence of tweets also seems greater, but this assumption still needs to be empirically proven (Brantner & Pfeffer, 2016).

Moreover, studies dealing with the localisation of contents are not restricted to geotagged information and check-in data. For example, 'geoparsing' automatically converts location names mentioned in text into coordinates (Wilken, 2014b). Obviously, geoinformation visualisation is not restricted to Twitter and is applied across many web-based platforms. To this end, numerous studies have been performed, such as those from the field of urban computing (see e.g. Cranshaw et al., 2012).

5.3 Geovisualisation of geotagged photos

When it comes to the analysis of geotagged pictures, researchers – mainly from the fields of computer sciences or computational social sciences – have addressed the possibility of algorithmic analysis of large datasets of digital images collected from social media (for an overview see Hochman & Manovich, 2013). These studies primarily pursue behavioural patterns and spatial traces by aggregating the spatial (and temporal) tags of the photos. For instance, Barchiesi et al. (2015) visualised the metadata of geotagged photos from locations within the UK uploaded to the photo-sharing platform Flickr and designed a machine-learning algorithm to model human mobility patterns. A further project referring to geovisualisation on maps originates from the data artist and software developer Eric Fischer. His *Geotaggers' World Atlas*, a series of topographical maps encompassing by now dozens of major cities,

employed the search APIs from the photo-sharing services Flickr and Picasa.[4] In the subproject *Locals and Tourists*, which recorded the maps from 136 cities, the geotags from the pictures uploaded to the platforms by tourists and locals were visualised in different colours on *OpenStreetMap* (see **Figure 2**). When we interpret the taking and uploading a photograph as an act of assigning meaning and significance to a particular place, such a map shows which distinct places and locations within a city the tourists and locals assign importance to. The visualisation of a section of the city map of Vienna indicates that the tourists (in red) upload most of all their geotagged photos of touristic hotspots from within and around the city centre as well as Schönbrunn Palace, whereas the locals also left their traces outside the centre and touristic hotspots (in blue).

In a similar project, Schwartz and Hochman (2015) analysed the meta-information of geo- and time-tagged pictures located in public parks in New York and shared on the photo-sharing platform *Instagram* and the LBS app *Yelp*. Schwartz and Halegoua emphasise that digital photos taken by users are expressions of their 'spatial self'. Consequently, the analysis of geotagged photos from platforms such as Instagram or Facebook facilitates the understanding of 'new performances of self and re-inscriptions of the body in place and space' (2015, 1656). Images taken on the move and shared on LBS or photo platforms serve as identity construction and for the creation of place attachment and memory making (Frith & Kalin, 2016; Hand, 2016; Özkul, 2015; Pink, 2011). The operators of these photo-sharing platforms also recognise this aspect: Instagram founder Kevin Systrom said at the launching of the feature 'Photo Map', '[w]e don't want Instagram only to be about "now", (…) [i]nstead we want Instagram to be a visual collection of your memories – something beautiful and nostalgic' (Bonnington, 2012). Indeed, the digital footprint of users on location-based social media assist the analysis of urban experiences and mobility, but they should be understood as fragments of physical presence and spatial realities, for they are only pieces of a grander

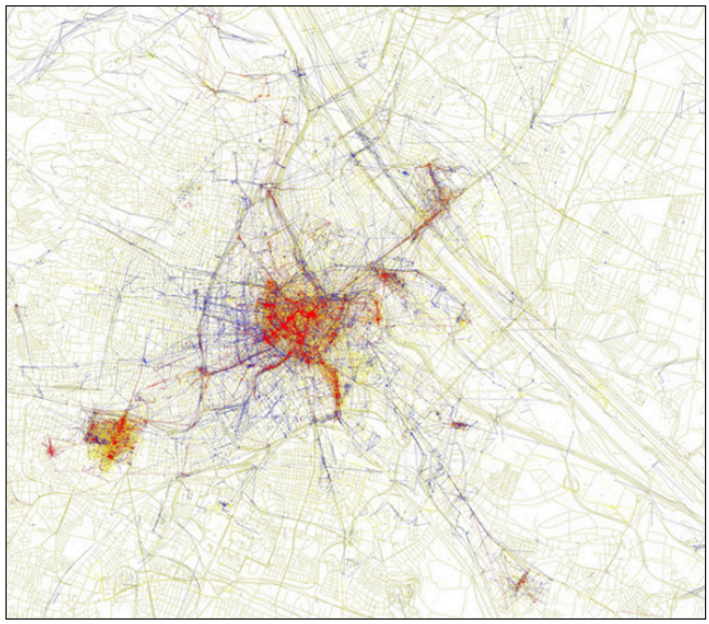

Figure 2: Screenshot of Vienna from the Flickr Album *Locals and Tourists.* In red, photos uploaded by tourists, in blue those uploaded by locals, in yellow those not assignable; CC BY-SA 2.0 Eric Fischer, Flickr.[5]

narrative and experience of place. Simultaneously the bias of the data as well as the politics behind the platforms must be borne in mind (Frith, 2017; Malik et al., 2015; Schwartz & Hochman, 2015).

Unlike in geovisual analytics, most of the available studies which analyse the metadata from pictures use only spatial, not temporal, data. Moreover, these studies employ only metadata and do not analyse the visual features of the photos themselves. A possible research strategy called 'thick visualisation', by Hochman and Manovich (2013), goes beyond metadata from photos and integrates quantitative and qualitative elements. The authors demonstrate how spatial-temporal visualisations of the geotagged photographs uploaded to *Instagram* can lead to cultural, social and political insights about people's activities in particular places at specific times. These visualisation techniques allow the comparison of millions of photos taken in different cities and the discovery of cultural differences among cities. Also 'stories' resulting from individual users' sequences of photographs can be visualised.

The data- and geo-visualisation of the geotagged information or pictures can be used to analyse the utilisation of urban public places. This information by itself delivers distorted results, but our understanding about public spaces can be completed only with the triangulation of qualitative and quantitative methods, which also take into consideration visual aspects (Adams & Jansson, 2012; Brantner & Rodríguez-Amat, 2016; Poorthuis et al., 2016; Schwartz & Halegoua, 2015; Schwartz & Hochman, 2015).

In this vein, interactive maps are employed for data collection, exploration or presentation in qualitative visual research (McKinnon, 2011), and they are often combined with other (visual) research techniques. In the following section, we outline some examples of this application of PGIS as methods of research and knowledge production.

5.4 Participatory geographic information systems (PGIS) in qualitative visual research

Collins (2011) outlines the potentials of PGIS for visual research, exemplified by a mixed-method project in the tradition of participative action research in which he explored the personal histories and cultural practices of the participants. He used inductive participatory methods and focused on the subjective perceptions and qualitative understandings of the people and the cultural life of local communities. Among other means, he used PGIS maps for visual elicitation.

Pauwels (2016) indicates the potentials of visual methods for the field of urban communication research and points out that the new locative visual technologies, such as action cameras (e.g. *GoPro*) or life-logging cameras, can be deployed for data generation. The visualisation of these data in PGIS not only opens new opportunities for dynamic and unobtrusive research on urban contexts but also allows the documentation of the behaviour of image producers, either researchers or respondents, through the marking of their 'views' on maps, both temporally and spatially.

The implementation of PGIS has intensified over the most recent decades in geography, social anthropology, participatory action research and visual sociology and other disciplines (Collins, 2011; Lapenta, 2012; McKinnon, 2011). PGIS have also been credited with high potential as tools of (direct) visualisation. With their help, the social practices, personal identities, interactions and 'imagined' communities of the users, who create the maps, can be made visible and researched (Lapenta, 2012; Pauwels, 2016). At a local level, they can be used for knowledge production and decision-making (Collins, 2011), and they are deemed valuable tools in interdisciplinary and mixed-method research (McKinnon, 2011; Pauwels, 2016). Such a project has been put into practice by Nacher (2013), who deals with participative mapping as a form of data-driven activism. She sees the primary function of the visualisations not in their representation of locations but in their role in the dynamic process of knowledge production at the grass-roots level (see Elwood & Leszczynski, 2013).

5.5 Emplaced visuality: Practices of locative smartphone photography

Hjorth and Pink (2014; Pink & Hjorth, 2012) developed the concept of 'emplaced visuality' in their ethnographic studies concerning mobile smartphone photography and geotagged photos and urged a deviation from the concept of 'networked visuality' (e.g. Ito & Okabe, 2006). For Hjorth and Pink (2014), smartphone practices, through the taking and sharing of photographs as part of everyday movements, provide new opportunities of thinking about place beyond the purely geographical aspect as users with their practices contribute by adding social, emotional, psychological and aesthetical dimensions to a place. Geotagged pictures are then doubly located: in the 'real' world, in which they were taken, and on the digital map (de Souza e Silva & Sutko, 2011). Also, in this regard, it is not expedient to see pictures only as representations for it is easily overlooked that they are products of the material *and* of the digital and that algorithms also contribute to the way in which practices are emplaced (Pink & Hjorth, 2012).

The content of digitally, socially and materially emplaced smartphone pictures is influenced by the textures of place, and their conditions and components, which in turn specify the emplacement of the user's body (Adams & Jansson, 2012; Brantner & Rodríguez-Amat, 2016). To this point, the act of photography can be grasped as a spatial practice, and the physical environment and places are perceived and experienced through the taking, collecting and sharing of photos (Pink, 2011). Whether geotagged or not, photos from places and in places, once inserted into live communication with physically absent others, create a special form of 'mediated presence' (Villi, 2016, 109). The picture contents, the depicted places and situations, become part of communication. Thus, this communication comes into being through pictures.

Photos create a type of co-presence (Pink & Hjorth, 2012). On one hand, they give to the remote communication partner the feeling of being at the scene and seeing the scene. On the other hand, the photographers deliver the indexical evidence of their presence at the location (Villi, 2016). This also applies in particular to LBS. However, unlike with networked visuality, in which the motions through space, time and place are frozen in the shared photos, in LBS practices, 'emplaced visualities are about an embracement of camera phone images as a copresent part of movement through place and spaces' (Hjorth & Pink, 2014, 51). Similarly, Özkul's (2015, 111) interviews with locative media users in London showed that feeling present and connected was the prime motivation for using location with photographs. This emplaced visuality also stresses the new paths on which cartographies of the social, spatial and geographical are located and interwoven. The practices are part of the cartographies, and the localities, representations and experiences are transformed using locative media. The focus on the use of technologies as part of the everyday brings new insights for non-representational analyses of everyday life. In this sense, they have been applied in geography or anthropology and also increasingly deployed in communication research (Pink & Fors, 2017; see also Adams & Janson, 2012; Nacher, 2013; Özkul, 2015).

Based on qualitative interviews with early adopters of the AR app *Layar*, Liao and Humphreys (2015) outline how mobile AR applications can mediate the practices of urban life. They identify two utilisation patterns primarily. Firstly, the users program contents on *Layar*, which communicate about and through a place. This forms their relationship with and interpretation of ambient places. Secondly, the augmented contents made available by the users historicise the significance of the places and challenge their meaning. At the same time, the augmented realities influence not only the expanded space but also the users and the creators of the technology as well as their perception of space. They can choose which space representations they want to see and how the augmented space looks for them. As neogeographers, they can challenge the dominant (place-)narrations and power relations when using objects from the physical space for stories which have not been told or have vanished

(Crampton, 2001; Dodge, 2014; Hoelzl & Marie, 2016; Liao & Humphreys, 2015). Thus, different stories can also exist simultaneously. Here, again, as regards the production of place, many questions on power relations arise. Not only the very small group of people that contribute content but also the 'codes' and algorithms inserted in the technologies determine the representations of place and influence how we see the world (Frith, 2017; Graham et al., 2013).

These five forms of research consider the ingrained aspects of data, visuality and social practices as core sources for understanding the new visual conditions enabled by locative media and geomedia. These new conditions configure a new environment that can be explained as a new visual regime.

6 Conclusion

A new visual regime is pushing a new research programme that needs to be configured out of the current concepts available in the literature and with a methodology that combines and creatively mixes the previously available and new methods: quantitative and qualitative, interpretive and critical, digital and ethnographic. This constitutes an opportunity and a challenge. Visual communication research is required to investigate and reflect precisely the impacts of algorithmic techniques of visualisation on visuality and on the visual regime (Liao & Humphreys, 2015; Uricchio, 2011), a 'regime that equates seeing with knowledge' (Rose, 2016, 3).

This article has brought together some of the most recent approaches in the discussion around the visual aspects of locative media and geomedia from an interdisciplinary perspective. It has dealt with the new techniques of geovisual analytics and other methods of the geovisualisation of geomedia-based information, in particular with those using geotagged tweets and geotagged photography. Researchers can interactively examine data following emerging social patterns and cultural practices. These options are also employed by commercial, non-commercial, (semi-)governmental actors and platform operators with various implications for the control, surveillance, privacy and commercialisation of spatial data. As argued, for the (further) development of visual theory in the context of geomedia, qualitative approaches are especially profitable. Also, users' practices of digital mapping have been examined, particularly focusing on PGIS maps that have high potential as visual research tools (Collins, 2011; McKinnon, 2011; Lapenta, 2012; Pauwels, 2016) but also as practical applications. In this context, the notion of 'emplaced visuality' has helped in understanding why digital maps transcend the strictly visual to become an integrated part of the physical environment: one moves with those maps, and inside them, and experiences them physically (Farman, 2012; Pink & Hjorth, 2012). This state of 'beyond' the visual shows the need to question the epistemological value of the relations between the object and its representation – the role of algorithms used for visual representation as well as their socio-cultural consequences and their social functions. These ought to be seen as the symptoms of the emergence of a new visual algorithmic regime. This means that the intrinsic 'logic' of the *visual algorithmic turn* has far-reaching consequences for visualisation and the relationship between image and 'reality', but it also affects the socio-cultural conditions of the algorithmic visual regime and its social functions and the related knowledge politics. For example, a hybrid visual situation appears through AR because the observers are in the 'real' place and see it, but at the same time this (point of) view is augmented (or perhaps limited) by algorithmic configurations.

This article is merely a possible starting point, and the notion of a visual regime that integrates geolocation and visuality is still a matter that requires further discussion. In this respect, the visual assumes a particular form of centrality in research on locative media and geomedia but also incorporates the iconic or pictorial turn and the increasing demand for a

debate about the visual modus and the functions assumed by images. Finally, apprehending the centrality of the visual will be crucial in tackling the changes in the relationship between object and subject in augmented reality and the question of how 'seeing' is affected. These are issues that research should address to a greater extent to better understand whether we can conclusively speak about a new *visual regime*.

Notes

[1] See, for example, *Amsterdam RealTime* from 2002 by Waag Society and Esther Polak, which crowdsourced a GPS-traced map of Amsterdam (http://realtime.waag.org/); the *GPSter* project from 2001, which was a public database allowing anyone to add and search for waypoints and aimed at 'building creative location-based projects, in order to give the general public and art communities access to the location-based technology' (Kalnins, 2002); or Jeremy Wood's GPS drawing project *My Ghost*– starting in 2000 he recorded his journeys with GPS to map and show where he had been and how he got there. 'It is a form of personal cartography that documents my life as visual journal' (http://www.gpsdrawing.com/maps.html).

[2] The Photosynth software, apps and website were discontinued in February 2017. However, most features were introduced in the camera app *Pix*. This is an example of a continuously changing market, in which new functions and applications come along constantly, and old ones disappear.

[3] https://www.geovista.psu.edu/SensePlace2/.

[4] Google-owned *Picasa* was discontinued in 2016.

[5] https://www.flickr.com/photos/walkingsf/4671527727/in/album-72157624209158632/.

Competing Interests

The author has no competing interests to declare.

Author Information

Currently Cornelia Brantner is working as project leader at IWAF (Institute for Knowledge Communication and Applied Research) in Vienna. In summer term 2017 she was (temporary) Professor of Media and Communication Studies at ZeMKI at the University of Bremen. From winter term 2015/16 to winter term 2016/17 she was (temporary) Professor of Communication at the TU Dresden. Prior to that she was Assistant at the University of Vienna and has spent time as a visiting scholar at the School of Computer Science at Carnegie Mellon University in Pittsburgh.

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