KAMIL NIEŚCIORUK
University of Life Sciences in Lublin
Department of Environmental Engineering and Geodesy
Lublin, Poland
https://orcid.org/0000-0002-0695-1195
kamil.niescioruk@up.lublin.pl

Like it! Maps as a subject and a springboard for discussion in social media

Abstract. In the modern world of mass information being reduced to colourful images, maps have the chance to become a medium that transmits important information in an attractive format. Due to time pressure, many cartographic publications that have a short life span on the internet contain a lot of methodological errors. Viewers receive an image that is hard to interpret, incomplete or even incorrect. The author aims to summarize and classify the cartographic content of social media, while bearing methodology, the role of the cartographer and users' reactions to that content in mind. The springboard to online discussion is mainly a map topic. Their design or methodology is of little interest in most cases. This may be due to insufficient knowledge of how forms (their correctness and quality) shape messages. Hence the role of the cartographer is important, what can be seen – among methodological remarks – as one of conclusions. It seems that map-makers are becoming more expert, and are guiding map lovers and amateur cartographers towards creating good, effective and elegant maps.

Keywords: map assessment, internet, map user, map design

1. Introduction

The goal of cartography has remained unchanged since its early days – to understand the world: show space, spatial data and spatial relations in a convenient, easy to understand and concise way using maps (A. Kent, P. Vujakovic 2017). For centuries, maps were the products of highly trained specialists. As geographic information was of importance in times of discoveries and colonization, and during wars and economic expansion (M. Sirko 1999), map-makers were valuable specialists with knowledge of data sources and techniques.

In recent decades, people have experienced immense technological changes related to the digital world. From the mainframe computers of the 1960s, civilization has reached a point where each and every person can be not only a recipient, but also a creator of global multimedia content using small, portable, and powerful devices. Maps are no exception here. With open access to spatial information and tools (from simple website creators to complex open-source GIS software), everyone can create a map (which provides great added value for professional activities, including production and research) (M. Dodge, R. Kitchin 2011). To become a creator is a tempting task for many map lovers in the world of constantly changing information. With the short life span of virtual information, the quality of the content does not seem to be as important as being able to inform and publish in general, as well as gain attention (K. Field 2012; K. Field 2014).

Homo interneticus, the Web 2.0 user, wants to be – as mentioned above – a creator. In the area of cartography, this can present in different forms. Volunteer geographic information (VGI) does not always involve pure cartographic design activities but is seen as the process of the creation of knowledge, including datasets

with spatial references (M.W. Brandeis, M.I. Carrera Zamanillo 2017; M. Czepkiewicz, P. Jankowski, M. Młodkowski 2017). Participatory GIS and crowdsourcing are the (semi)professional mapping activities that can empower open-source spatial database development. This is the foundation of many projects, including OpenStreetMap and its spin-offs, as well as research, official spatial databases, and crisis situation and humanitarian needs databases (S.B. Liu, L. Palen 2010; E.A. McCartney 2015). Participatory cartography is even seen as having its roots in the implementation of mental map theories (J. Pánek 2016). A significant number of digital map users and fiends do not want to go that far, however. All they want is to look at interesting maps and, at most, create simple cartographic content on the go, using templates, in just a few clicks.

The question that arises in the new situation described above concerns the role of professionals (understood here as people having professional, formal qualifications and education, not people creating maps professionally). Cartographers no longer have a monopoly on making maps – a fact arising from the popularity of tools and data. Should they insist on being the only ones to work with spatial data legitimately? Should their role diminish like other currently irrelevant professions? Or maybe their role, besides still making good maps, should be to guide all unskilled map lovers through the tools and, crucially, the rules of good mapping?

The importance of this question can be easily seen while browsing any map-related services and web pages on the internet. Maps are ubiquitous there. There are good, well-designed maps with interesting data, there is interesting information hidden under the insufficient cartographic means of communication, and there are cartographic catastrophes, breaking all the rules of data manipulation, presentation and graphic communications (K. Field 2014). Some cartographers have already accepted that online media has liberated, or even opposed, the approach to traditional cartographic conventions and rules (D.R. Green 1999; D.E. Cosgrove, V. Dora 2005), but the opinion of professionals is worth taking into consideration when evaluating maps. This trend also includes deliberately creating maps that are more sensational and propagandist than impartial and informational (I. Muehlenhaus 2012).

2. The goal of the research

This paper aims to analyse the internet map content of the selected example through the point of view of methodology and the rules of presentation. When a cartographic message can be irrelevant, false or hard to interpret as well as being stunning, beautiful and intriguing, it is interesting to look at social media users' reactions to these maps, as social media is an important channel for the transmission of ideas and opinions. A map, thanks to its ability to simplify complex spatial phenomena, is a perfect tool for communication (A.C. Robinson 2019). The idea behind this research is to check if the methodology or the graphic form of a map sparks any reaction, or if it is a topic that only garners special attention if it is controversial or deals with recently discussed events or ideas. The analysis can help to answer what role a professional cartographer plays in the internet-media mapping environment, as well as what role the user plays, being not only the recipient of the information (whether in the form of text, map or video) but its creator or sub--creator who has defined the map content (J.W. Crampton 2001).

The subject of the analysis was the content of the Facebook group 'Jak będzie na mapie? – sekcja geograficzno-kartograficzna' ('What does it look like on a map – geographic and cartographic section') which has over 26,000 users who can post any map-related information – maps created by them or maps found on other groups and sites. The timescale of the analysis was one month of group activity. The study included 57 maps (numerous non-map posts and links to map-related content were not included) and approximately 540 comment threads on them (not including replies to comments). This group was selected because of the users' activity – its content was created by them, contrary to Facebook fan pages, where only the owner or moderator can create and/or post maps. A good example is a very popular Polish fan page 'Kartografia extremalna' ('Extreme cartography') that has almost 100,000 followers. Of course, user-generated content and users' cartographic creativity is not limited to Facebook groups or Polish-speaking parts of the internet, not to mention map-related discussions on aggregators like Reddit and Wykop or many (micro)blogs. The author, however, decided to

take a closer look at the Polish map-loving community.

3. Results

Reactions to posts are an important part of discussion. Of all the comments, 84.1% were on topic, 14.6% were off-topic (jokes, internet memes, etc.) and only 1.3% (less than two comments per post) were about cartographic aspects of the post. This is not a surprise, as such groups are not the place for academic discussions. It is important, however, that such a methodological perspective was present in the discussion, which will be analysed later in this paper.

3.1. Topics, tools and methodology controversies

The posts that sparked the most discussion were, of course, on controversial or very recent topics. A good example was a post on the legal status of marijuana around the world. The map received 26 reactions and 36 main comment threads. Some topics and maps were so heavily discussed, including insults and foul language, that the administrators had to turn off the commenting options. This was the case for political (the partition of Ukraine between Poland and Russia as shown on Russian TV), socio-economic (to some surprise – the iPhone index showing how long people in European countries have to work to buy a new iPhone) and social (same-sex unions) topics.

Maps posted on the analysed group were partly created by its members and partly materials linked from other sources (including other map-related groups). Members were mostly map lovers without a professional background in maps, but some were map-makers, GIS specialists or professionals in spatial-related fields, and students. This has serious consequences for the methodology, but also for the quality of the maps, both in terms of visual solutions as well as data manipulation.

Undoubtedly, creating a map is not an easy task – raising issues related to thematic and background data, as well as issues concerning the use of visualization and data manipulation software, etc. The entry level for GIS programs is pretty high, as they are complex, multi-purpose tools. With proper but still basic knowledge, GIS can serve as an efficient tool to produce

a correct map; however, it does not guarantee this (for example, it is the role of a designer to use proper data for certain methods and presentation subjects). For all those who cannot or do not want to enter into the complexity of dedicated software, there are plenty of simple tools to create maps. These include online applications which, with three clicks, allow an area and data to be selected, and provide a choice of colours to 'paint' a map in the form of a choropleth map, regardless of whether the data are suitable for this method. However, simple solutions give less control and need less knowledge; hence, these maps are often far from perfect in many ways. They are being published because this is part of the nature of internet content and communication – the aim is to gain attention, to be the first to publish, to get people talking about your content, to create so-called clickbait (K. Field 2012; J.N. Blom, K.R. Hansen 2015). Maps are no exception here (I. Muehlenhaus 2014). An ever- and rapidly changing digital world often has no time for the complexity of the correct solutions, but this topic is yet to be deeply analysed, especially in the context of social media maps, their design and viral character (A.C. Robinson 2019).

The analysis of the group's content shows there are maps that are controversial in their methodological basis as well as in data manipulation, but they draw attention due to their interesting graphic outcome. A map of the distances to US national parks can serve as an example here. These were measured using neither metrical units nor time, but using the number of counties that had to be crossed to get to the nearest park. As a numerical result this could be justified as a correct approach, but the map says nothing about real distances in a practical sense, as the size of counties in western and eastern US states differs significantly. The resulting map had the appearance of a very pleasant and elegant visual composition, but the methodology was dubious. Both facts drew the attention of group members, who commented on the aesthetic and cartographic elements of the map.

3.2. Discussions on methods and data manipulation

Despite the small number of methodological comments and reactions of group members it

is worth taking a closer look at this part of users' activity. Methodology is one of the topics of this discussion. The most significant theme is the form of the choice of presentation, which is analysed in detail below. Other topics often discussed, as far as the cartographic aspects of these maps are concerned, were historical data shown on a modern background or generally irrelevant background information. These include sketches, imprecise and/or misleading borders, modern hydrography (including artificial lakes) on a 16th century world map, or the very recent political problems of borders in the example of Crimea, which is shown on some maps as being a part of Russia. The problem of projections appears in the discussions almost only in the context of the much-popularized Mercator conformal projection and the problem of inducting unreal areas and proportions to inexperienced users. The exception is the interesting case of anamorphic cartograms. One case of such a map of malaria victims, showing an oversized Africa and stretching the other continents, caused almost all commenting users to refer to the map form instead of its subject. It is worth stressing that the main topic of discussion was not the methodology in its pure form but rather that it produced shock, surprise or jokes over the form of the map. This shows that modifications such as this are sometimes hard to understand, interpret and often read, despite well-developed methodology and the increasingly improved quality of digital tools for anamorphic maps (H. Sun, Z. Li 2010; A. Faliszewska 2012; A. Markowska, J. Korycka--Skorupa 2015).

An anamorphic Dorling cartogram is an extreme case and a controversial method. Of the classic methods described in cartographic literature, all but one was present in the group in the analysed period. The only one missing was the dot map. On the one hand, this is no surprise, as this method, having great potential for showing the distribution of phenomena, is very complex and resource-consuming to create. On the other hand, a false version of the dot map can easily be created in popular GIS programs. 'False' because what is offered in GIS is often far from the real method, where each dot represents a number of phenomena (this condition is satisfied) and the placement of dots is connected with the distribution of the phenomena (this condition is often not satisfied, with

dots randomly distributed, just keeping the correct total volume). The other methods (cartogram/choropleth, diagrams, chorochromatic, distribution, symbols, and isolines) were present in different numbers. The values are shown in figure 1.
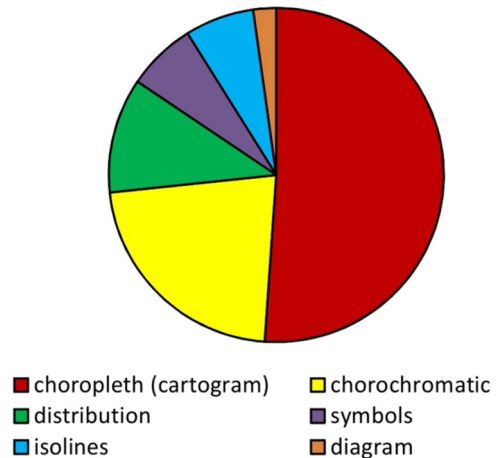

Fig. 1. The distribution of cartographic presentation methods used in maps posted in the analysed group

The clear dominance of choropleth maps can be observed. It seems that a choropleth map is easy to create, and it suffices to fill in the data and spatial units with a few colours. However, the method is much more complex, including the widely discussed problem of data classification and its influence on the way the user reads a map (G. Andrienko et al. 2001; C.A. Brewer, L. Pickle 2002; T.A. Slocum, et al. 2009). The most common errors made on choropleth maps are the lack of normalization, which is – according to cartographic and perception theory – the only acceptable approach, the way data are treated, and the problem of the definition of what a related (normalized) value is (M. Tomaszewska 2009). Absolute values shown in spatial units using this method are considered wrong. However, both GIS software and simple online map creators do allow such maps to be created. Hence, it is the responsibility of the maps' author to conform to methodological recommendations. Sadly, some

inexperienced users are not even aware of this and – above all – the justification for this rule. The resulting maps are then somehow controversial in terms of proper perception (not to mention data classification problems). The other, more visual problem with a choropleth map is colour scale selection, as the logical visual relation (for example, higher value – darker, more intense colour with gradient step-by-step change) is not always used (fig. 2). The numbers show how common the absolute value error is. Of 23 choropleth maps (51% of total) posted in the group, about 50% (12) used non-normalized data. An example of a simple map using non-normalized values can be seen in figure 3.

The other method frequently used is, maybe surprisingly, the chorochromatic map. This is a method for simply distinguishing spatial facts on a nominal level, without including values. A chorochromatic map is easy to create and, as such, often found in the media. The visual aspects are similar to a choropleth map, but – as was said – with no values shown, hence it is less problematic and less vulnerable to errors. With the colours in spatial units distinguishing different phenomena or aspects of them, it is pretty easy to create, at least, a satisfactory cartographic message. Still, graphic communications should be efficient – this is mainly a case of selecting logical colours to avoid unpleasant effects. Choropleth maps were the second most popular method in the group in the analysed period, with 22.2% of all posts. It should be mentioned that this includes both good and really bad maps. The latter are presentations that should definitely be avoided or are of low informational value. An example would be a map with only two options, one of which dominates (for example, countries using Celsius and Fahrenheit scales) which really needs no map to show this properly; not to mention simple
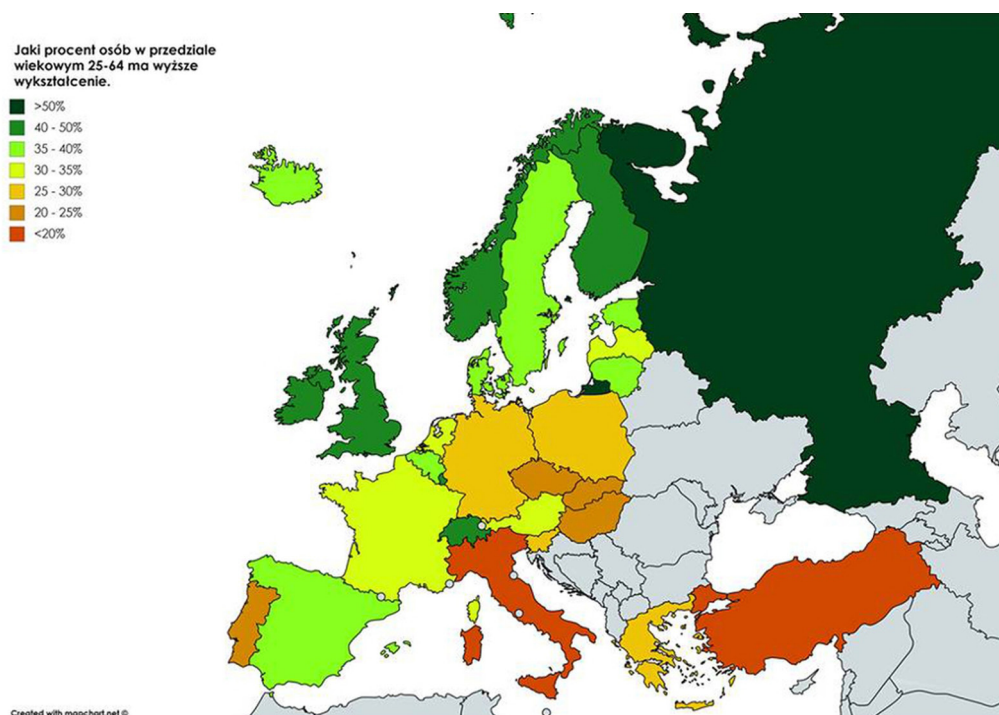

Fig. 2. Map posted in the analysed group showing the percentage of people aged 25–64 with a university degree. Relative data choropleth map with a hypsometry-like colour scale not matching the increasing phenomena values (reproduced with the permission of its author)
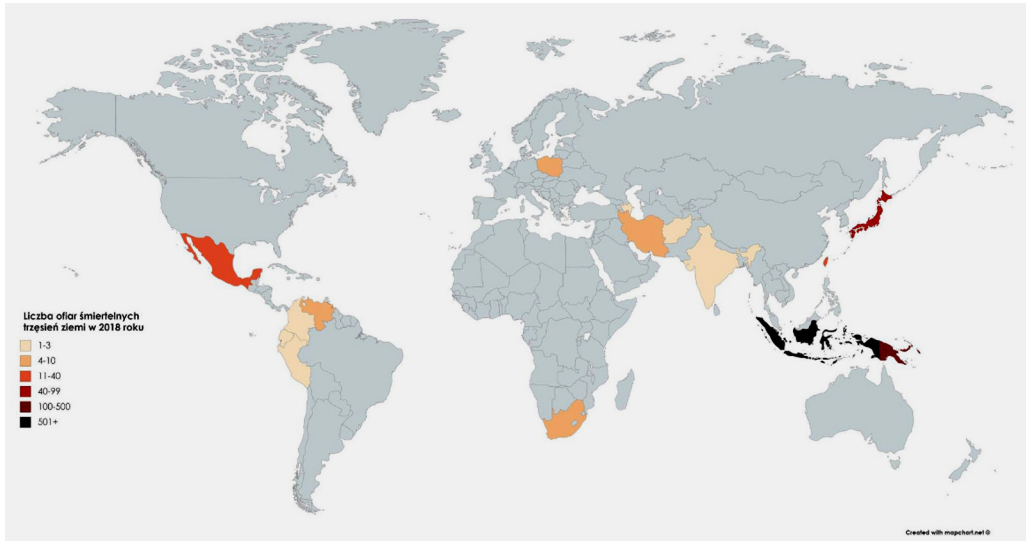
Fig. 3. Map posted in the analysed group showing the number of deaths in earthquakes in 2018.
A correct colour scale along with presentation of total values in spatial units (a diagram map would be
a better solution here) (reproduced with the permission of its author)

jokes showing, for example, 'countries that are Poland' and 'other countries', which is an empty graphic message with only one area shown.

The third most popular method is that of the distribution map. Five maps of this kind were posted during the analysed period. Most of them were simple presentations of no more than a few colours. The only methodological discussion that took place was related to a possible mistake in the full-colour zones in the case of overlapping areas. Using precise borders for zones suggests dichotomy delimitation which is not always true (in the case of a dialect map, for example, as dialects always overlap and spatially fade at the edges of usage areas). Instead, other graphical solutions should be used – for example, two-colour hachures or zones delimited with borderlines only (with no colour fill).

The remaining methods occurred in small numbers. There were three point symbol maps and three isoline maps. These numbers may be a little surprising, but this may be a matter of statistics and too short an observation period. Symbol maps are easy to create, but they are not good at presenting area-related classified or value data and – as observation shows –

these are the most common phenomena presented on the analysed maps. Isolines are of some surprise here, as this method is one of the best developed in GIS, with many interpolating methods and easy-to-use and correct template visualization solutions. The problem may be a lack of data, as most isoline maps need discrete data as an input. Even more shocking is the fact that only one map was a proportional symbol map (circle diagram). It was a well-designed map on the subject of Islamic dress in public, developed as a diagram and combined with a choropleth map. The explanation for the lack of diagrams, which are easy to create with the relatively good tools in GIS software, may be the fact that many inexperienced users understand the diagram as point-related, while it can be point-, line- or area--related. This is a shame as the method is very informative and can be easily combined with a cartodiagram, showing different aspects of the same phenomena using absolute and relative data. A disadvantage of this relatively easy method may be the pretty complicated way of creating a proper legend, as many GIS programs fail in this aspect.

The discussion and remarks on methods and methodology above can be supplemented by general information on typical mistakes made in maps, regardless of the methods used. Figure 4 presents these data. They are evaluated according to the author's knowledge and experience. The most common error (forming one third overall) is using absolute data to produce choropleth maps. This was broadly discussed in the previous section. The problems with projection include overusing conformal projections for area-related topics or the graphic distortion of a map to fit a pre-defined image size. Typical data manipulation mistakes were that questionable coefficients were used or the wrong method for the phenomena was selected. Some errors were basic design problems, for example colour scale not corresponding with a change in value (topographic green–yellow–red for income, no sequential colours), the lack of a legend to explain the colours representing the values, or putting numbers on maps when the diagram size or the colour explains the values in a proper legend. Some one-off mistakes include making maps for one-sentence data (for example, a map showing countries – but literally one country – using the Fahrenheit scale) or using incorrect background data (a complex problem when designing historical maps).

4. Conclusions

The above analysis revealed a few interesting facts. Maps, as with any other online content, may have a short lifetime. Approximately two map posts per day (plus other posts) causes all information (whether a valuable and well--designed map or not) to be buried under new content. This results in users participating in the discussion and commenting on a post just to observe and track the comments and reactions of others, which may be seen as a positive impact of cartographic information. On the other hand, it is very easy to miss potentially interesting or well-designed content. This is part of a much broader problem of data digging and the internet being seen as a global pile of everything (K. Field 2014).

The role of a map as a discussion starter is no surprise, as maps can show a wide range of topics. The more recent, or even controversial, the better in the dynamic online world. Hence, a very different attitude in participants' discus-
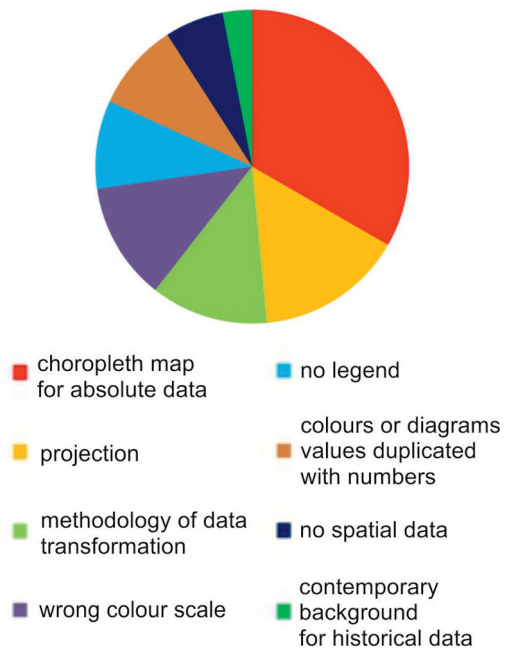

Fig. 4. The distribution of typical errors on the maps analysed

sions can be observed. Some users just post a meant-to-be-funny, meaningless comment or slogan. Others ask about the nature of the phenomena or even the map itself, trying to understand why it looks the way it does. Some of the comments also include very professional information. Over a quarter of the 100,000 users in this group are map lovers, so it is no surprise that this group includes professionals of very different and wide-ranging subjects. Hence, it is pretty likely that there will be comments explaining a phenomenon, its nature, its spatial distribution or the cartographic aspects of the presentation.

The representation of different cartographic presentation methods among the posted content may be seen as partly random. This may be especially due to the short research period. What is most surprising is the lack of diagram maps which are easy to create and understand, even if creating a meaningful legend can be a little troublesome. The other intriguing fact is the small number of isoline maps, which have a solid theoretical and practical background in GIS. The explanation may be the

lack of data in this case. In summary, it is worth stressing that the maps were not created solely by group members. In fact, no more than half of them were members' creations. The others were reposts from other groups or online media; hence, it was easy to encounter a map made by a professional, who was aware of the methods and technical means to overcome the above-mentioned problems. On the other hand, some of the reposted maps were made by graphic designers who prepare illustrations for the news, for articles, etc. and are not always very fluent in cartographic communication design.

In this situation, the problem of the role of the cartographer can be discussed. It is obvious that professional map-makers are no longer the only legitimate map authors. In the digital world of open data, open software and DIY applications, anyone can make a map. Should everyone do so? Some cartographers may say 'no', but for many this profession has undergone a major shift from its members being keepers of high-class 'secret' knowledge to being guides and leaders of an army of eager amateur cartographers; leaders not only in terms of technical knowledge but also of the ethics and truth of depicting spatial phenomena (A. Kent 2017). Online content is easily accessible, so the way to spread cartographic knowledge among digital and social media map lovers seems to be an uncomplicated task. If people wish to do so, it is a matter of choice and individual preference as to whether they provide a general step-by-step guide or share their knowledge, suggesting modifications and explaining rules to such groups, as analysed in this paper. The problem is whether users are ready and willing. The other approach can be to use the typical social media 'weapon' – instead of academic discussion, guides and teaching, a cartographer can simply promote and share good online cartographic content.

Asking users of the analysed group about the need for professional explanations and guidance on how to make maps produced very different feedback and reactions. Most of them were positive, with users wanting to see online educational content on map-making. However, some were afraid of such guides being too professional, at the level of academic lectures and books. Some answered in a negative way, claiming the social media map group exists as a kind of entertainment, and they need nothing

more (otherwise they would decide to study the subject at university). An interesting observation was that some users backed up their positive reactions with arguments over technical issues, referring to often-asked questions in the group about how to start, what software to use, where to find data, etc. Every time such a question appears, it is analysed and answered, but some kind of general basic guide is still undoubtedly needed.

The portion of maps analysed that were posted in the cartography-lovers social media group mainly gave interesting results, especially in two areas.

Method popularity and map quality is one of these issues. The easiest maps to create are pretty common; hence they are quite vulnerable to methodology errors and visual communication mistakes. Half of the analysed choropleth maps could be questioned on the basis of their methodology (Fig. 4), while there were also interesting and well-prepared examples of this method. The more demanding methods were less popular, sometimes surprisingly, as – for example – diagram maps are not that hard to create in GIS software. The spectrum of design styles and methods clearly shows there is a place for cartographers, with discreet guidance and knowledge, to help users create better maps (if they are willing to learn and find out more, which is not always the case). This opens up possibilities for further research on other content (not only one fan page, and for longer than a one-month period, etc.), and analysing the reactions of users. The latter is important, as we still know very little about social media users' knowledge and cartographic literacy (A.C. Robinson 2019).

This relates to the second area mentioned above – the role of the cartographer in the recent digital, open-data, rapidly changing world of information. This topic has been discussed in recent decades (W.R. Buckingham, S.F.Jr. Dennis 2009; M.-J. Kraak 2011). This is definitely a period for re-defining the role of map-makers. But again, the reactions of non-professionals should be taken into consideration. Do people really need guidance and knowledge about maps? Is it the role of cartographers or teachers at school to deliver spatial-awareness classes? It seems such knowledge is useful, but we should redefine people's needs. Maps are rarely tools to find one's path in the wilderness now.

Maps (or spatial data) are tools to explain not only 'where?', but rather 'why?', 'why here?' and 'what if?'. This is widely accepted among professionals, as the above-mentioned online journal discussion shows. The next step is to spread this attitude and knowledge among regular users, to equip them not only with data, GPS, LBS, VR and all the high-tech of mobile phones, but also with an understanding of space and its depiction. Is there a cognition barrier in the form of cartographic illiteracy and the lack of a need for good or better maps? If so, the only answer may be education, not only in formal settings but also within the popular (even viral)

content of social media. These questions and problems need to be answered by cartographers, provided that they want to play a vital role in the global mapping society.

Acknowledgements

Literature

Andrienko G., Andrienko N., Savinov A., 2001, *Choropleth maps: Classification revisited*. In: "Proceedings of the 20th International Cartographic Conference – ICA 2001, August 6−10, 2001, Beijing, China", pp. 1209−1219.

Blom J.N., Hansen K.R., 2015, *Click bait: Forward-reference as lure in online news headlines*. "Journal of Pragmatics" No. 76, pp. 87−100. DOI: https://doi.org/10.1016/j.pragma.2014.11.010

Brandeis M.W., Carrera Zamanillo M.I., 2017, *Finding meaningful participation in volunteer geographic information and citizen science: a case comparison in environmental application*. "Cartography and Geographic Information Science" Vol. 44, no. 6, pp. 539−550, DOI: https://doi.org/10.1080/15230406.2016.1221779

Brewer C.A., Pickle L., 2002, *Evaluation of methods for classifying epidemiological data on choropleth maps in series*. "Annals of the Association of American Geographers" Vol. 92, no. 4, pp. 662−681, DOI: https://doi.org/10.1111/1467-8306.00310

Buckingham W.R., Dennis S.F. jr., 2009, *Cartographies of participation: How the changing natures of cartography has opened community and cartographer collaboration.* "Cartographic Perspectives" No. 64, pp. 55−61, DOI: http://dx.doi.org/10.14714/CP64.150

Cosgrove D.E., della Dora V., 2005, *Mapping Global War: Los Angeles, the Pacific, and Charles Owens's pictorial cartography*. "Annals of the Association of American Geographers" Vol. 95, no. 2, pp. 373−390, DOI: https://doi.org/10.1111/j.1467-8306.2005.00465.x

Crampton J. W., 2001, *Maps as social constructions: power, communication and visualization.* "Progress in Human Geography" Vol. 25, no. 2, pp. 235−252, DOI: https://doi.org/10.1191/030913201678580494

Czepkiewicz M., Jankowski P., Młodkowski M., 2017, *Geo-questionnaires in urban planning: recruitment methods, participant engagement, and data quality*.

"Cartography and Geographic Information Science" Vol. 44, no. 6, pp. 551−567, DOI: https://doi.org/10.1080/15230406.2016.1230520

Dodge M., Kitchin R., 2011, *Mapping experience: crowdsourcing cartography*. "Environment and Planning A", Vol. 45, no. 1, pp. 19−36, DOI: https://doi.org/10.1068/a44484

Faliszewska A., 2012, *Badania czytelności kartograficznych anamorfoz powierzchni*. "Polski Przegląd Kartograficzny" T. 44, nr 3, pp. 225−238.

Field K., 2012, *Mapping the London 2012 Olympics*. "The Cartographic Journal" Vol. 49, no. 3, pp. 281−296, DOI: https://doi.org/10.1179/0008704112Z.00000000033

Field K., 2014, *The cacophony of cartography*. "The Cartographic Journal" Vol. 51, no. 1, pp. 1−10, DOI: https://doi.org/10.1179/0008704114Z.000000000120

Green D.R., 1999, *Journalistic cartography: good or bad? A debatable point*. "The Cartographic Journal" Vol. 36, no. 2, pp. 141−153, DOI: https://doi.org/10.1179/caj.1999.36.2.141

Kent A., 2017, *Trust me, I'm a cartographer: post-truth and the problem of acritical cartography*. "The Cartographic Journal" Vol. 54, no. 3, pp. 193−195, DOI: https://doi.org/10.1080/00087041.2017.1376489

Kent A., Vujakovic P., 2017, *Introduction*. In: A.J. Kent, P. Vujakovic (eds.), *The Routledge Handbook of Mapping and Cartography*, pp. 1−5.

Kraak M.-J., 2011, *Is there a need for neo-cartography?*. "Cartography and Geographic Information Science" Vol. 38, no. 2, pp. 73−78, DOI: https://doi.org/10.1559/1523040638273

Liu S.B., Palen L., 2010, *The new cartographers: crisis map mashups and the emergence of neogeographic practice*. "Cartography and Geographic Information Science" Vol. 37, no. 1, pp. 69−90, DOI: https://doi.org/10.1559/152304010790588098

Markowska A., Korycka-Skorupa J., 2015, *An evaluation of GIS tools for generating area cartograms*. "Polish Cartographical Review" Vol. 47, no. 1,

pp. 19−29, DOI: https://doi.org/10.1515/pcr-2015-0002

McCartney E.A., 2015, *Crowdsourcing the national map*. "Cartography and Geographic Information Science" Vol. 42, no. 1, pp. 54−57, DOI: https://doi.org/10.1080/15230406.2015.1059187

Muehlenhaus I., 2012, *If looks could kill: the impact of different rhetorical styles on persuasive geo-communication*. "The Cartographic Journal" Vol. 49, no. 4, pp. 361−375, DOI: https://doi.org/10.1179/1743277412Y.0000000032

Muehlenhaus I., 2014, *Going viral: the look of online persuasive maps*. "Cartographica" Vol. 49, no. 1, pp. 18−34, DOI: https://doi/org/10.3138/carto.49.1.1830

Pánek J., 2016, *From mental maps to geopartici-pation*. "The Cartographic Journal" Vol. 53, no. 4, pp. 300−307, DOI: https://doi.org/10.1080/00087041.2016.1243862

Robinson A.C., 2019, *Elements of viral cartography*. "Cartography and Geographic Information Science" Vol. 46, no. 4, pp. 293−310, DOI: https://doi.org/10.1080/15230406.2018.1484304

Sirko M., 1999, *Zarys historii kartografii*, Lublin.

Slocum T.A., McMaster R.B., Kessler F.C., Howard H.H., 2009, *Thematic cartography and geovisualization*.

Sun H., Li Z., 2010, *Effectiveness of cartogram for the representation of spatial data*. "The Cartographic Journal" Vol. 47, no. 1, pp. 12−21, DOI: https://doi.org/10.1179/000870409X12525737905169

Tomaszewska M., 2009, *Sposób ujęcia danych a po-prawność map opracowanych metodą kartogramu*. "Polski Przegląd Kartograficzny" T. 41, no. 3, pp. 209−220.