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INFLUENCE OF THE CITY MAPS' CONTENT ON THEIR LEGIBILITY

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Abstract: City maps are certainly among the group of commonly used and automatically widely published cartographic products. Last several years have brought an important changes to the wealth, variety, level of graphic form and detail of the city maps' content. This has been noticed especially in the Central and Eastern European countries. This is a consequence of the political and economic transformation, resulting in the abolition of censorship and introduction of the free market. These changes may be considered as a cartographic breakthrough in the representation of cities. Due to those transformations city maps could have been shown in defined scales, with no distortions and with detailed presentation of built up areas and their functions. Transformations also brought significant changes to the city maps content. Earlier forbidden features could finally have been represented on the city maps. The paper shows influence of the censorship abolishment, competition in the publishing market and broad city maps users group on city maps content extension. Such extension causes that city maps are often illegible for a common user. The usefulness of such a overloaded city maps is being reviewed.

Keywords: city map, city map content, graphic form, feature density, cartographic symbols, map perception

Introduction

City maps are certainly among the most commonly used and widely published cartographic products. The development of mass and individual tourism, as well as ever-increasing migration for non-tourist purposes (industry, business, conferences, etc.) further the purpose and importance of city maps. It should be mentioned that city maps are not only used by city visitors, but also by citizens, particularly in the larger cities. Such a wide user-group forces city maps to be as universal as possible and so their content is often very extensive.

Significant changes in the wealth, variety, level of graphic form and detail in the content of city maps are noticeable in recent years, particularly those from Central and Eastern European countries (Martyński, Ostrowski 2003). This is a consequence of the political and economic transformation, resulting in the abolition of censorship and introduction of the free market. These changes may be considered as a cartographic breakthrough in the representation of cities (Ostrowski J., Ostrowski, W. 1975, Ostrowski 1976, Kałamucki 1994). The case in point is situation on Polish cartographic market (Ostrowski W., Ostrowski, J. 1973). In Poland, as in other countries of the region, number of publication significantly increased. Differentiation of map content, their graphic form and level could also be observed. Due to strong competition on publishing market authors of city maps include more information, in order to attract more users. This information often exceeds limits of perception of a common user. Such cartographic publications are hardly legible or simply not useful for application, due to their excessive loading and lack of respect of graphic rules. Hence one should wonder, to what extent enrichment of city maps' content is useful and when it makes its utilization more difficult.

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City maps before political transformation

City maps may be considered as a kind of re-interpretation of the detailed topographic maps, supplemented with thematic content, mainly tourist one. It should be emphasized, that contrary to majority of thematic maps, topographic content on city maps does not form a background information, but rather co-creates main content of city map itself. Restrictions in access to topographic maps and limitations on their usage in other publications in countries of Central and Eastern Europe after the Second World War had an important impact on presentation of the cities in this region. Topographic maps, and so the topographic content, were classified. In order to show on city maps indispensable elements of topographic content, it was necessary to distort, simplify and present them partially. Thematic content was presented mainly with the use of point symbols, as this way of presentation was censored to less extent. So, it can be said, that point symbols replaced topographic location of objects.

In first years after Second World War (till 1949) both topographic and thematic content of city maps still were not restricted by the censorship. It is exemplified by presence of the features recognized as strategic (i.e. railway sidetracks, industrial plants, airports, etc.) on these maps. There were no new-elaborated city maps that time, pre-war Polish and German adaptations were only published (Konopska 2007). Early organization of censorship immediately after the war had also influence on this situation.

Beginning of the 1950s. resulted in significant restrictions on city maps' content, mainly concerning topographic information. Undoubtedly, these restrictions were caused by strong activity of the censorship. The most characteristic features of the city maps of that period are: lack of presentation of built-up areas, strong limitation of surface elements, reduction of thematic content to public transportation network and a few other selected features, and serious simplification of street network, see Fig. 1 (Kałamucki 2001). The maps are also characterized by distorted cartometric features, as well as lack of projection grid and scale information.



Fig. 1. Sample of the city map of Białystok and its' legend published in the late 1950s. by PPWK

Relatively quickly, at the beginning of the 1960s., slight extension of the city map content could be observed. Selected cultural objects (cinemas, theatres, museums) and objects useful for motorized users (petrol stations, diagnostic stations) were presented using geometric symbols (Fig. 2a). In the mid-1970s. city maps were supplemented with the simplified information of built-

up areas. Range of tourist content, presented still with the use of point symbols, was also extended (Nerlo 1986). Censors still did not allow for presentation of feature outlines, so cartographic point symbols were used to “smuggle” as much information to the city maps as possible. It is important, that in this period geometric symbols were completely replaced with associative ones (Fig. 2b). City maps were still characterized by significant image deformations and hence irregular variability of scale; it implied their serious drawback – lack of scale information.



Fig. 2a City map of Białystok with some geometric point symbols published in 1964 by PPWK

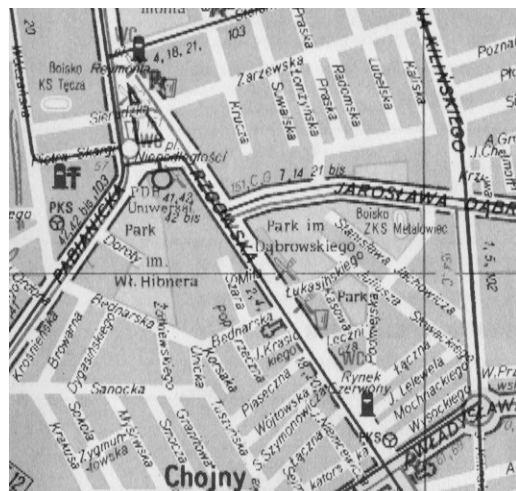


Fig. 2b City map of Łódź with simplified outline of built-up area published in 1964 by PPWK

New political system, new city maps

Turning point in cartographic presentation of cities occurred in the mid-1980s., after liberalization of censor instructions. It may be stated, that it preceded political transformation, which started to develop at the end of the 1980s. At that time city maps, elaborated according to a new concept, both thematic and graphic, appeared on the market. Topographic information started to be presented; it was no more distorted, simplified or limited. City maps were prepared on the basis of large-scale topographic maps and geodetic plans, additionally verified and supplemented in the course of fieldwork. Cartometric character is a new feature of city maps prepared in this period, as well as scale information and kilometre grid, along with higher number of presented features, especially those, which were so far prohibited. The most important innovation introduced in this period, however, was detailed presentation of built-up areas, including their functional characteristics. Built-up areas were presented in topographic way, delineating all residential, industrial and public buildings. Owing to this approach, character of built-up areas in cities was depicted, with differentiation of high-density built-up areas in new districts and low-density areas in exclusive residential and sub-urban districts. Built-up areas were also differentiated due to their functionality. The following elements were delineated: residential buildings, historic buildings, public buildings, industrial and storage areas with usually generalized building structure (Ostrowski W, Ostrowski J. 1992, 1998). Road and street network was also presented as precisely as possible. Local paths within districts were shown on the maps, as well as shape and arrangement of crossings, roundabouts, junctions, traffic safety islands; it caused that city maps started to be more similar to topographic maps (Fig. 3a, 3b).

Turn of 1980s. and 1990s. caused further changes on the cartographic market. It was caused by both full abolishment of censorship, which gave map editors freedom in planning map content and level of detail, and strong competition, which emerged on publishing market. Free market economy resulted in emergence of new publishing companies, which had city maps elaboration in their profile. Competition forced maps authors to put on maps more detailed information, in order to attract wider group of users.

End of century resulted in further changes, mainly in graphic form. It was caused primarily by wider application of computer-aided techniques in cartographic production. Present publications are fully prepared in digital form and adjusted to use with GPS. Adjustment of map to use with GPS implied cartometric requirement - information on cartographic projection and incorporation of cartographic grid. Therefore, after nearly fifty years, city maps users could finally use publications, which fulfil basic map requirements: mathematical background and related information.

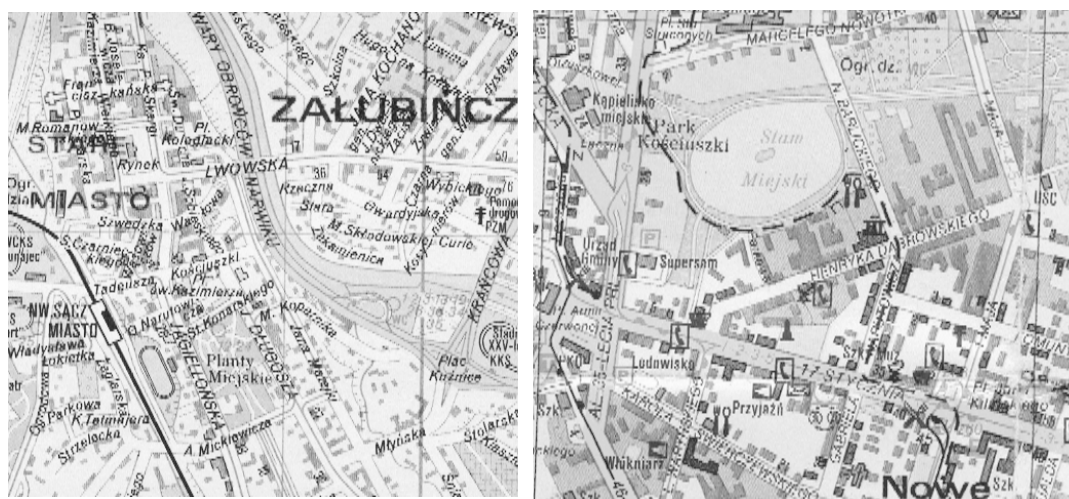


Fig. 3. Full content shown on the city maps published by PPWK in the second half of the 1980s.
a) Nowy Sącz, 1986 b) Zgierz 1987

Content variety and legibility of city maps

Private cartographic companies, which came into existence in the course of last 20 years significantly extended cartographic publications offer on Polish market (Fig. 4.). Along with number of publications, the diversity, regarding scale, number of object's categories, accuracy and level of detail of the presented topographic content (in particular built-up areas), as well as graphical level, has considerably increased.

Range of map content, as it was already mentioned, has been also extended, mainly due to declassification of many objects, such as police stations, rescue service stations, hospitals, etc. Adding new, previously prohibited, categories was the natural reaction to former restrictions. Besides, as a result of economical transformation, new objects appeared. They were readily placed on city maps (e.g. hypermarkets, cash machines, internet cafes). Moreover number of objects within certain categories significantly increased (banks, hotels, restaurants). One came to believe, that "the wealthier map the better". Adding new features to a map implied also more extended legend, which in turn caused that use of map for a user became more difficult.

In the period, when built-up areas could not be presented or were shown only by simplified outline, even numerous symbols were easily legible on poor topographic background. When the censorship was abolished, new maps started to be published with the detailed presentation of built-up areas. This kind of presentation caused that symbols, placed on the background of particular buildings, are not sufficiently legible. It is well seen particularly on small-scale maps and in case of improperly selected colours for built-up areas. Moreover, excessive number of symbols makes perception of city map more difficult. It is especially observed in large cities centres, where density of objects presented with symbols is the highest.

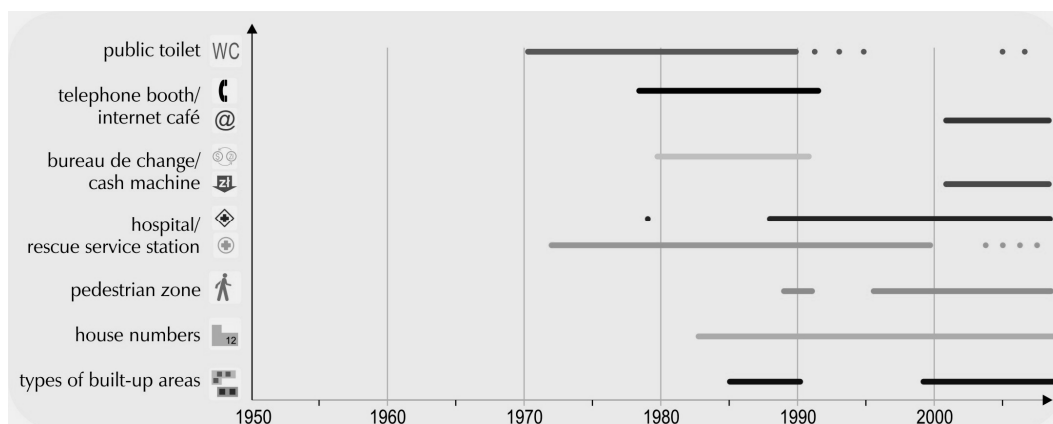


Fig. 4. Changes of the city maps' content published in Poland along past 60 years.

Problem of legibility, and in consequence effectiveness of using city maps is dependent not only on high number of symbols and their high density. Relation between background (mainly built-up areas) and symbols is also the crucial factor influencing legibility of city maps. Legibility is affected by: mosaic pattern of background (i.e. degree of generalization of built-up areas) and contrast between symbols and background (degree of visibility). Therefore, way of presenting built-up areas is one of the basic factors deciding about information value and legibility of city maps. There are distinct differences in presentation of built-up areas on lately published city maps – one can meet various degrees of their generalization, next their differentiation and finally various forms of graphic presentation. According to degree of generalization city maps can be divided into 3 basic groups. First group contains city maps, which comprise all individual buildings. At smaller scales (1:15 000, 1:20 000) usually quantitative generalization is required at the high-density residential areas (Fig. 5a). The second group includes city maps, in which individual buildings within high-density zones are joined into built-up areas, whereas separate buildings or their small groups are usually enlarged (Fig. 5b). The last group comprises city maps, which are characterized by the highest degree of generalization, similar to that applied to maps published for large cities in Poland in second half of the 1970s. On these maps all urban areas, also with low density (block or residential) are presented as homogeneous built-up areas with highly simplified shapes (Fig. 5c).

If built-up areas are presented on city map in first or second group, in conjunction with high number of point symbols, an effect of poor legibility can be often obtained. This, unfortunately, characterizes considerable number of lately published city maps. There are two ways of overcoming such situation: presenting multi-family buildings as separate symbols, while single-family residential areas as area symbol of built-up areas or representing built-up areas by a contour, on which only selected objects are outlined. Such a way of presentation simplifies final image significantly.

It's also worth to mention, that in Polish cartography cities were usually presented up to their administrative boundaries (West-European city maps often include only central districts). It forces their relatively small scales (1:20 000 – 1:30 000). High number of symbols, presented in small scale and on diversified background also impact legibility of city maps. It should be mentioned here, that problem of legibility and excessive map content also concerns city maps at larger scales. Freedom and competition in cartography caused, that even large-scale city maps (1:4 000 – 1:7 000) are characterized by excessive content, as authors attempted to include too much information. As an example the map of the centre of Warsaw with all gastronomic objects and their names may be quoted. Certainly, apart from city maps, where many object categories were presented with the use of point symbols, there are also maps, in which number of symbols is very limited. These maps sometimes seem to be "empty" – and this impression is often justified.

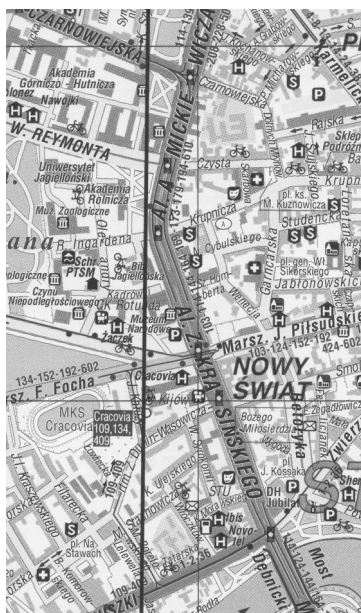


Fig. 5a. Built-up areas presented by showing individual buildings (Kraków 1:20 000, Compass, 2004)



Fig. 5b Built-up areas shown by an individual buildings as well as surface symbol of built-up areas (Poznań 1:20 000, Copernicus, 2007)



Fig. 5c Built-up areas shown by a surface symbol (Warszawa 1:26 000, Jokart, 2008)

Conclusions

It should be considered, which maps are better from common users point of view – these with very detailed and rich content or those simplified, sometimes schematic ones. Undoubtedly, correctly edited city map should take into consideration both expectations and needs of potential users as well as principles of theory and cartographic methodology, having in mind use of modern technique for map preparation. This is a kind of challenge for authors of city maps: to select map content adequately as well as to prepare correct graphical solution and to choose proper scale of presentation thoroughly. It should be considered, that too high number of presented features often leads to situation, when deriving information from city map for a common user is much more difficult. It requires some time to form a certain cartographic tradition, which will allow for preparation of ambitious and sustainable city maps, taking into account their form and content.

So it seems to be important to undertake studies on legibility and effectiveness of city maps, which will correspond not only to analysis of perception of particular symbols, but also to the entire image, concentrating on perception of cartographic information on higher, synthetic level.

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R e s u m é

Vplyv obsahu máp miest na ich čitateľnosť

Mapy miest patria medzi najpoužívanejšie a najbežnejšie publikované kartografické produkty. Rozvoj masovej a individuálnej turistiky, ako aj stále sa zväčšujúca migrácia za nie turistickým účelom, podporujú účel a dôležitosť máp miest. Významné zmeny v bohatstve, rozmanitosti, úrovni grafickej formy a detailu v obsahu máp miest sú viditeľné v posledných rokoch, obzvlášť tých z krajín strednej a východnej Európy. Je to dôsledkom politickej a ekonomickej transformácie majúcej za následok odstránenie cenzúry a zavedenie voľného obchodu. Uvažovaný prípad je situáciou na poľskom kartografickom trhu. V Poľsku, ako v iných krajinách regiónu, sa významne zvýšilo množstvo publikácií, ako aj diferenciácia mapového obsahu a ich grafická forma a úroveň strednej a východnej Európy boli klasifikované topografické mapy ako aj topografický obsah po druhej svetovej vojne. Za účelom ukázať na mapách miest nevyhnutné prvky topografického obsahu bolo potrebné ich skresliť, zjednodušiť a prezentovať len čiastočne. Tematický obsah bol prezentovaný hlavne použitím bodových znakov, aj keď tento spôsob prezentácie bol cenzurovaný v menšom rozsahu. Na mapách miest boli zanedbané kartometrické črty, ako aj mnoho iných objektov zakázaných cenzúrou. Počas 60-tych a 70-tych rokov sa situácia neustále zlepšovala. V druhej polovici 80-tych rokov sa úplne zmenila, keď sa objavili na trhu mapy miest zhotovené s novým obsahom. Začali byť zobrazované topografické informácie; mapy miest neboli viac skreslené, zjednodušené alebo limitované. Najdôležitejšou inováciou z tohto obdobia bola detailná prezentácia zastavaných areálov zahŕňajúc ich funkčné charakteristiky. Následkom tohto prístupu bol znázornený charakter zastavaných plôch v mestách s diferenciáciou na husto zastavané oblasti v nových štvrtiach a na oblasti s nízkou hustotou zastavania v štvrtiach s exkluzívnymi rezidenciami a na predmestiach. Zastavané plochy boli diferencované taktiež na základe ich funkcionality. Obrat v 80-tych a 90-tych rokoch spôsobil ďalšie zmeny na kartografickom trhu. Boli spôsobené úplným odstránením cenzúry, silnou konkurenciou a širším použitím počítačových techník v kartografickej produkcii.

Široký rozsah obsahu, prezentovaný pomocou bodových znakov, bol ľahko čitateľný, keď zastavané plochy nemohli byť prezentované alebo boli zobrazené len jednoduchým obrysom. Avšak, keď konečne všetky obmedzenia v zobrazovaní topografických informácií boli odstránené, kartografické bodové znaky, umiestnené na podklade vytvorenom z jednotlivých budov, sa stali nedostatočne čitateľnými. Je to špeciálne pozorovateľné v centrách veľkých miest, kde je najvyššia hustota objektov zobrazená znakmi.

Problém čitateľnosti a následne efektívnosť použitia máp miest závisí nielen na vysokom počte znakov, ale aj na ich vysokej hustote. Vzťah medzi pokladom (prevažne zastavané plochy) a znakmi je tiež rozhodujúcim faktorom majúcom vplyv na čitateľnosť máp miest. Čitateľnosť je ovplyvnená: vzorkou podkladu (t.j. stupeň generalizácie zastavaných plôch) a kontrastom medzi znakmi a podkladom (stupeň viditeľnosti). Preto spôsob zobrazenia zastavaných plôch je jedným zo základných faktorov rozhodujúcim o informačnej hodnote a čitateľnosti máp miest.

V dôsledku silnej konkurencie na vydavateľskom trhu autori do máp miest zahŕňajú viac informácií s cieľom prilákať viac používateľov. Tieto informácie často presahujú limity vnímania bežného používateľa. Takéto kartografické diela sú ťažko čitateľné alebo jednoducho nepoužiteľné v dôsledku ich nadmernej záťaže a nerešpektovaniu grafických pravidiel. Malo by sa zväziť, ktoré mapy sú lepšie z hľadiska bežných používateľov – tie s veľmi detailným a bohatým obsahom, alebo tie zjednodušené, niekedy schematické. Bezpochyby, korektne vydaná mapa mesta by mala brať do úvahy ako očakávania, tak aj potreby potenciálnych používateľov, ako aj princípy teórie a kartografickej metodológie, majú na pamäti použitie moderných techník na tvorbu máp.

Obr. 1 Príklad mapy mesta Białystok s legendou vydanou PPWK v 50-tych rokoch 20. st.

Obr. 2a Mapa mesta Białystok vydaná PPWK v r. 1964 s vybranými geometrickými bodovými symbolmi

Obr. 2b Mapa mesta Łódź vydaná PPWK v r. 1964 s jednoduchým ohraničením zastavaného areálu

- Obr. 3 Úplný obsah máp miest vydané PPWK v druhej polovici 80-ych rokov 20. st. a) Nowy Sącz 1986,
b) Zgierz 1987
- Obr. 4 Zmeny obsahu máp miest publikované v Poľsku v priebehu uplynulých 60 rokov
- Obr. 5a Zastavané areály prezentované zobrazením individuálnej zástavby (Kraków 1:20 000, Compass
2004)
- Obr. 5b Zastavané areály zobrazené individuálnou zástavbou (pôdorysy budov) ako aj areálovým znakom
(Poznań 1:20 000, Copernicus 2007)
- Obr. 5c Zastavané areály zobrazené areálovým znakom (Warszawa 1:26 000, Jokart 2008)

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