Using in-depth group interviews to optimize the design and communication of city maps produced for the public

Beata Konopska

Institute of Geodesy and Cartography, 27 Modzelewskiego St., PL 02-679 Warsaw, Poland
Tel.: +48 22 3291900, Fax: +48 22 3291950, E-mail: beata.konopska@igik.edu.pl

Abstract: The paper presents a study of city maps using the in-depth group interview method and discusses the use of the results obtained in optimizing the effectiveness of cartographic communication. This study indicated the content of city maps and their graphic form preferred by their users, and showed the extent to which educational gaps in map-reading skills lead to losses in cartographic communication. The results of the study were used to develop editorial and technical principles regarding city maps offered under the brand name of *Copernicus* by the E. Romer Polish Enterprise of Cartographical Publishing Houses S.A [Polskie Przedsiębiorstwo Wydawnictw Kartograficznych im. E. Romera S.A.].

1. Introduction

A city map is the form of cartographic communication which map users have the most frequent contact with. Proof of this is formally specified number of copies sold by the cartographic publishing houses. The immediate impulse to use a city map is the need to obtain information related to the geographic space of a particular area. Firstly, the user expects to obtain this information from the city map and, secondly, they expect the information obtained to be credible.

These seemingly reasonable expectations were discussed in Poland at a time when numerous, and not always properly developed, maps of cities serving important administrative, tourist, cultural, health and other functions appeared on the publishing market. Users, limited by their own perception, used maps that they found possible to read and understand; in other words, they would choose those maps whose effectiveness of cartographic communication, understood as the effectiveness of communicating information, was in their individual case the highest. However, the choice which the user made was not always consistent with the expectations of cartographers. Therefore, it became

legitimate to undertake research aiming to identify the conditions and the process of map selection by users and their preferences regarding the scope of the content, graphics and editorial form. What was most desired was to obtain such information which, combined with the knowledge of map editing, would allow the optimization of the efficiency of the cartographic communication of a city map.

In this context, the aim of the study was to try to formulate answers to three questions:
- what information do users actually look for on a city map?
- what type of graphic form is to be applied, so that the information presented on a map is legible to users?
- in what way do users' educational deficiencies in map-reading lead to losses of information transfer by maps?

One form of dialogue between the author of a map and the map user is direct interviews, both individual and group ones. They are an effective tool, making it possible to get to know users' opinions about the graphic design already functioning on the publishing market or the projected one. These opinions may be obtained in a direct way (an answer to a closed question in a telephone survey or during

an interview), or indirectly, as a result of a combined analysis of the whole context of an answer provided, which consists of a verbal part and non-verbal events accompanying it (in-depth individual and group interviews).

An in-depth group interview is a discussion led by a moderator in a team of several people, participants in the study. Therefore, it is not a simple sequence of questions and answers, but a conversation conducted according to a predetermined scenario. The questions included in the scenario play the role of stimuli intensifying such a discussion. Their main task is to find out the causes of behaviour, the motives governing reactions, as well as the attitudes and beliefs of respondents which were undisclosed directly. As a result of the analysis of such a survey one can obtain answers to many questions that begin with "why", "what are…", "how is it proceeding", etc. The simultaneous acquisition of two messages – the primary one, closely associated with the speech apparatus and the non-verbal one, complementary and making the basic message clearer – is a unique advantage (Žaltman, 2003; Wendland, 2008). This comprehensive approach to the statements of people involved in the discussion meant that the results obtained using the tried and tested in-depth group interview method are more credible and more useful for cartographic practice; the advantages of this method were characterized in the separate paper (Konopska, 2012).

The in-depth group interview method was applied for the first time in 2000 (Konopska, 2001) to investigate in detail the Polish market of cartographic publications, including city maps, and has not been reused in Poland as far as it is known, although this method is widespread in the social sciences. The group in-depth interview in studies conducted for the purpose of its application in cartography was used by the geography professor, Mark Monmonier (the author of graphic scripts) and Myke Gluck (an expert in human-computer interaction "HCI") in their study of perception of dynamic phenomena on multimedia maps (Monmonier and Gluck, 1994). In turn, studies closer to those described in this article were conducted by a team under the direction of Judy M. Olson, who studied cartography graduates' opinions about the presentation of different elements of the contents of maps based on the example of their campus

map, for the purpose of practical use of the results by publishers of cartographic publications (Olson *et al.,* 1998). The method of in-depth group interviews was also welcomed by William Cartwright (2010), who in his "Effectiveness of Metaphors" writes about the results of testing the concepts of different representations of geographic information in interactive applications used in cartography; it has also been welcomed by Virizi (1992).

2. Research material and method

The study was conducted in two stages, primary and complementary, obtaining a total of about nine hours of interviews. The primary study was carried out with map users with respect to cartographic publications for general use (including universal city maps) available on the market. The complementary study, in turn, was conducted on specially developed parts of a city map. In both cases, the method of the in-depth group interview was applied, although in the case of the complementary study, focusing it around a few problems rendered it more similar to a focus group (Fig. 1).

Fig. 1. One of the focus groups
(Warsaw, September, 2000)

The method of focus groups has been known since the 1930s, its theoretical foundations being two areas of knowledge: qualitative research methodology and social psychology. The term "in-depth interview" means that a conversation is non-superficial because it is a discussion, and not a sequence of questions and answers; "group", because research is carried out in a group (several participants); "focused" determines that an interview is focused around a single issue (Maison, 2001). The inter-

view is conducted according to a predetermined scenario, according to which a moderator leads a conversation on a given topic. The questions included in such a scenario are the primary stimuli intensifying the discussion. Their main task is to reach the causes of behaviour, motives governing reactions, attitudes and beliefs. Questions are non-leading, specific ones, not imposing expectations of certain results. A study of one group lasts from one to two hours. The moderator is responsible for the introduction of all relevant topics into the discussion topic. In a well-conducted interview participants talk directly to each other and to the moderator.

The interviews were conducted by the Foundation for Public Opinion Research Centre (CBOS) [Fundacja Centrum Badania Opinii Społecznej] – professional company, commissioned by the E. Romer Polish Enterprise of Cartographic Publishing Houses S.A. (PECPH) in September 2000.

The study was conducted in Warsaw and Gdansk in five groups of 8-10 people[1]. A total of 44 adults were tested, 23 women and 21 men. Each of the interviews lasted almost two hours and proceeded according to a predetermined scenario. The participants in the study had been selected from a representative group using the random selection method, i.e. they were adults having in their domestic resources cartographic publications and at least one car in the household or a driving licence.

In the primary study, map users spoke about maps and atlases, including city maps, offered on the Polish market by domestic and foreign publishers. About 7 hours of research material were obtained from this study, containing opinions and indicating preferences of the respondents relating to a variety of cartographic publications presented to them. The opinions obtained concerned, inter alia, the scope of content and visualization of its elements, as well as the ergonomics of respective publications, in particular the size, type, binding and method of folding.

The complementary interview, in turn, was focused solely on city maps, and its participants spoke about the generalization of the content of the maps presented to them and the visualization of their individual parts. In this interview harvested ap-

proximately 2 hours of material for analysis. The cartographic material, which was used during the complementary study, consisted of fragments of a city map developed with the same geographical coverage (limited to size A4) and to the same scale (1:20 000). Fragments used in this study differed in visualization and generalization. The participants in the study received 5 sets of maps (Fig. 2), developed in five different generalizations, from the most detailed representation with the size of descriptions compatible with the rules of map graphics (Set 1), to a generalized image with enlarged symbols and captions (Set 5).
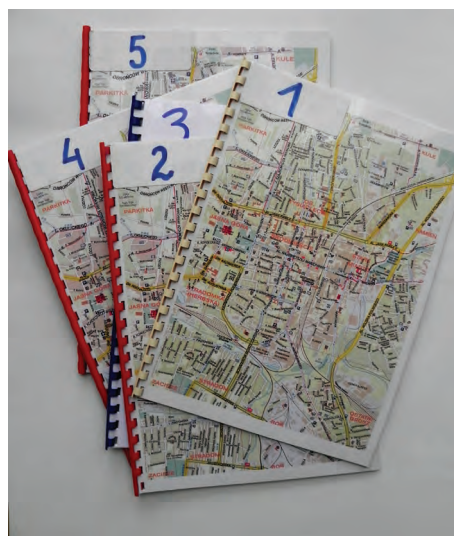

Fig. 2. Five sets of maps in five different generalizations and in 14 variants of visualization

In each set (1–5), were placed 14 variants of visualization, arranged in a similar order and forming several groups of colour (Fig. 3).

The differentiation of visualization of individual elements of the content of a map (surface, linear, and point, as well as descriptions) was achieved through the use of graphic variables (colour, size, shape, saturation, brightness). In this way, 14 colour variants were developed, some of which can be described as unconventional, others alluding to the colour of city maps found on the European cartographic market (German, Czech, Hungarian, French, Polish, etc.), and it was these that determined several colour groups differing in saturation or brightness.

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[1] According to Sagan (1998, p. 137), the number of group members participating in an interview generally amounts to 6–8 people in European countries, and 10–12 people in the United States.
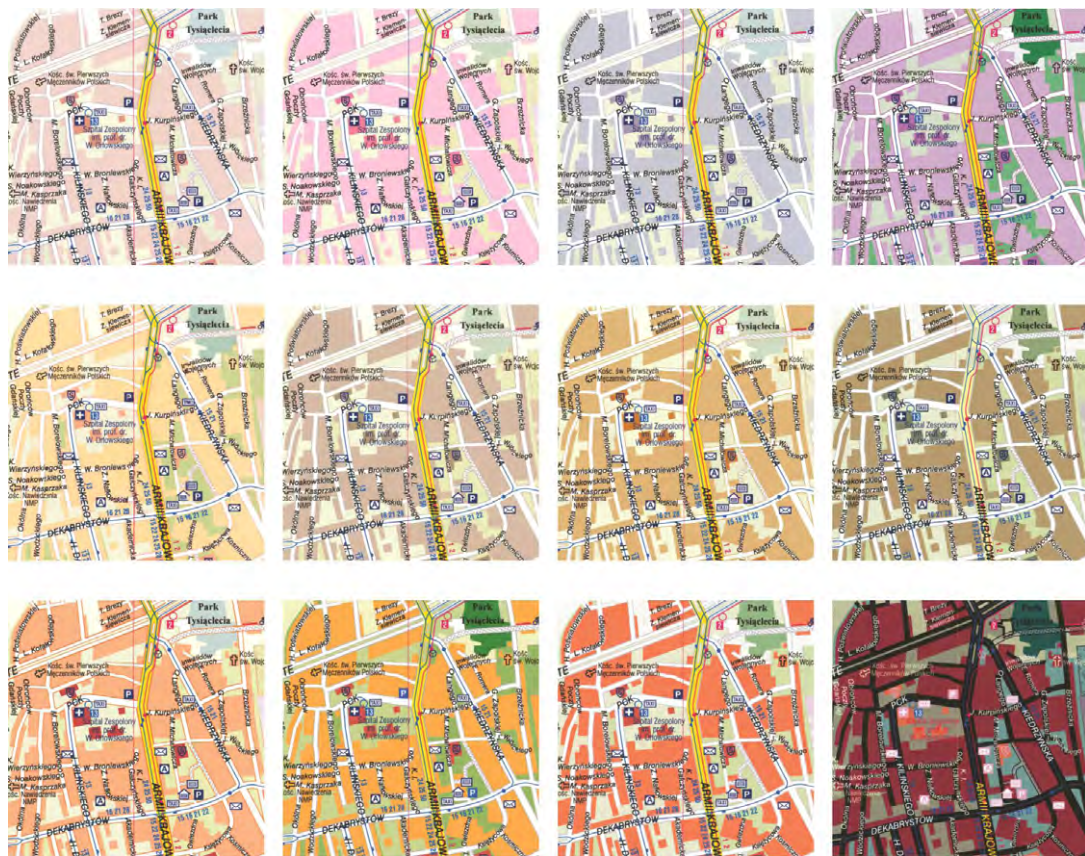
Fig. 3. The examples of visualization used in the study

3. Results and discussion[2]

3.1. The perception of the content of a city map

As resulted from the interviews conducted, the users used city maps primarily to obtain information useful in finding a specific address, and that other elements of the content shown on the map were considered to impede the use of the map, which was a surprise. The primary study indicated, and the complementary one confirmed, that the most important information for the respondents is the descriptions of streets, for many of them followed by the numbering of properties, to an accuracy of a quarter/district. Probably for this reason gained popularity navigation maps in the ICT devices (Information and Communication Technologies).

The interviewees' statements about the usefulness of individual elements of the content showed that the amount of geographic data contained in universal city maps which were used in the studies was beyond their expectations and perceptual capabilities. In their statements they suggested selecting content for elements resulting from the needs of specific users. Differences regarding the needs of motorists and those going on foot emerged during the primary study, and those relating to the needs of people fairly well understanding the content shown on the maps and those having great difficulty reading them, during the complementary interview.

Differences in users' needs similar to those indicated above were observed under the influence of opinions relating to the visualization of individual

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[2] The course of interviews together with quotations from the statements of people participating in the study were presented in Konopska (2013).

pieces of the content. The respondents evaluated the proposed visualizations primarily in terms of conditions, such as lighting, movement speed, etc., in which they could potentially use them.

In both studies, the participants indicated maps with overly exposed descriptions, especially those of streets, as the most "legible" ones. Similarly, in the complementary study the size of descriptions was the element of the content which they paid particular attention to. When asked to describe the differences between Sets 1–5, they pointed to the font size, yet they did not see differences in the size of symbols or the generalization of surface elements. They discovered the significant fact that Set 1 is the most detailed one (Fig. 4), and Set 5 presents the most generalized picture (Fig. 5), only in the second phase of the discussion, clearly directed by the moderator.

They completed the task aimed at selecting maps of optimal detail after a long discussion. In their first reaction they indicated the most generalized ones, but it was not their final choice. They verified it during the discussion under the influence of statements made by people showing the practical usefulness of various elements of map content which they happened to use in the past. Finally, they found the maps of cities with a lesser degree of generalization more optimal than those indicated at the first impulse.
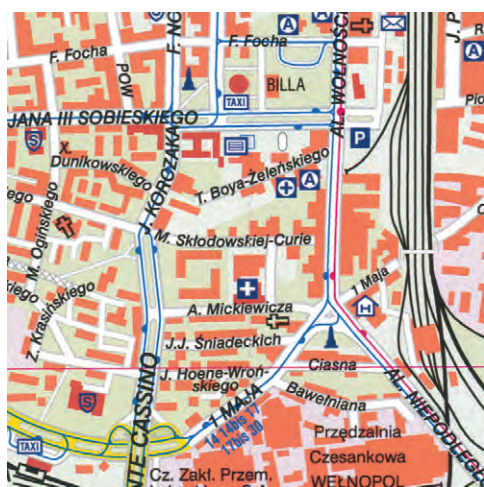

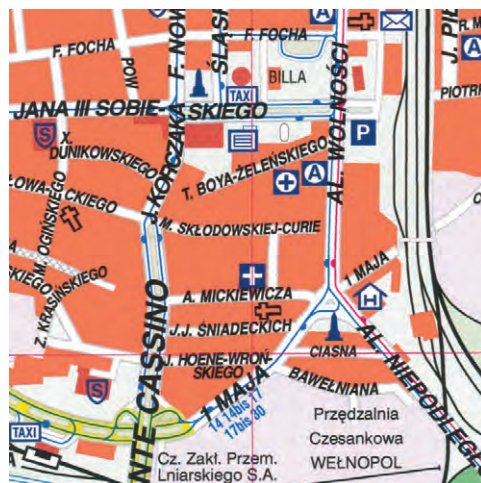Fig. 4. Set 1 – the content of the map at the highest level of detail

Fig. 5. Set 5 – the content of the map at the highest level of generalization
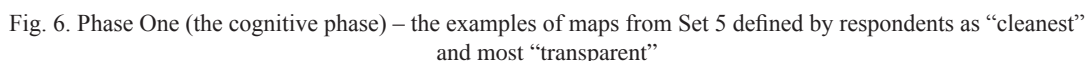
3.2. Understanding the content presented on a city map

In the course of the complementary study three phases, i.e. cognitive, educational and verification, were clearly marked.

Phase One, the cognitive phase, like the primary study, provided information on the actual level of understanding of the content of a city map and the skills of using it by persons participating in the study. It also confirmed that the most important information on city maps is large and legible descriptions of streets. In this phase, the majority of the respondents indicated the maps from Set 5, with the biggest descriptions and where surface elements were the most generalized, as the "clearest" and the most "transparent" ones (Fig. 6).

In Phase Two, the educational phase, the study participants acquired the necessary minimum map-reading knowledge and their information capabilities. One of the participants indicated in their statements the values of the map as a source of information about the area, which encouraged the others to a closer investigation of the map tested. As a result, the people who in the first phase of the study declared mainly the use of information about the location of a street began to notice in the sample tested also other elements of its content. The manner of making a statement and the tone of the voice

Fig. 6. Phase One (the cognitive phase) – the examples of maps from Set 5 defined by respondents as "cleanest" and most "transparent"

were at first marked by surprise, and then by recognition of these "newly discovered" elements of the content as obvious and traditional for each map. The part of the city map gradually discovered during the interview became more legible and understandable.

Psychologists describe this type of behaviour as a natural process. Recipients often evaluate something as inappropriate or unattainable, until after a more thorough examination they come to the conclusion that it is achievable and understandable. According to psychologists, they are influenced by stereotypes that push them to uncritically accept limitations (Falkowski and Tyszka, 2006). The tendency of the respondents in this phase to determine various elements of maps or form of the presentation of the contents as "traditional" attested to referring to their own memory. This process, in turn, is referred to by psychologists as "internal source of information", which includes, among others, information acquired in the past from external sources (Falkowski and Tyszka, 2006). Those respondents who gave the impression that they often used city maps pointed to "traditional" solutions as the "right" and "correct" ones. A similar approach also appeared in a discussion of the colours of a map and this will be discussed in Section 3.5.

Phase Three – verification. In this part of the study the participants, under the influence of the knowledge acquired in the educational phase, veri-fied their opinions delivered at the beginning of the interview (cognitive phase), indicating the ultimate scope of content and optimal graphic solutions. The verification of their selection was a result of a discussion in which they spontaneously realized the values of the map as a source of information. They rejected Set 5, which most of them had indicated as the most "legible" in Phase One, and focused on Sets 1–2. At the end of the study the participants represented the opinion that a city map should take into account the maximum amount of information that it is possible to include in it. As a result, they selected Set 2 as optimal, choosing high detail of the content with the image of buildings, showing their character (Fig. 7).

3.3. The perception of point symbols

The interpretation of the relationship between a topographic object and the symbol representing it proved to be a considerable problem for the respondents. They noticed especially those symbols that were described on the map. The order of reading led from a description to a sign (Fig. 8a). Symbols, especially point ones, with no description were incomprehensible for the respondents (Fig. 8b). Looking at the map they gave the impression that they did not see them, as if they did not notice their existence. The size of symbols was not relevant for this purpose, since the respondents reacted in the
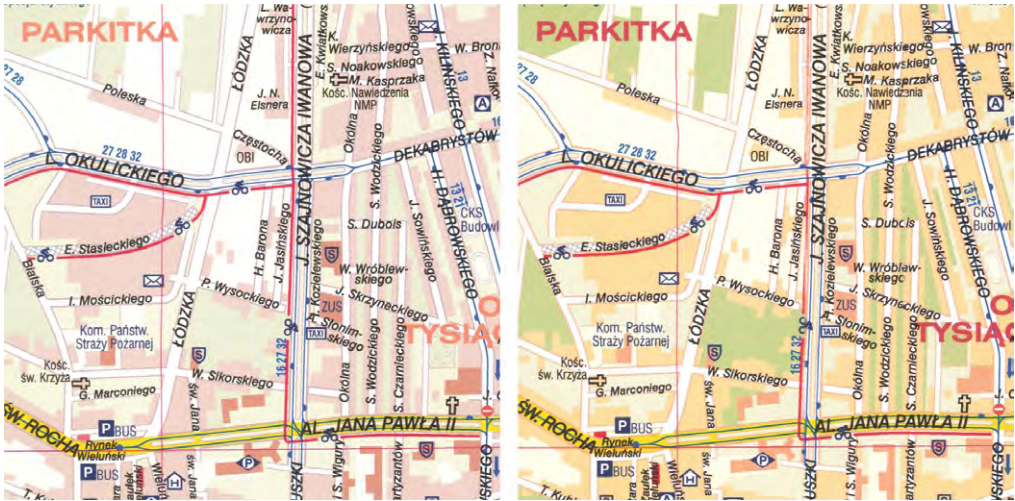
Fig. 7. Phase Three (the verification phase) – an example of maps from Set 2 defined by respondents as "optimal"
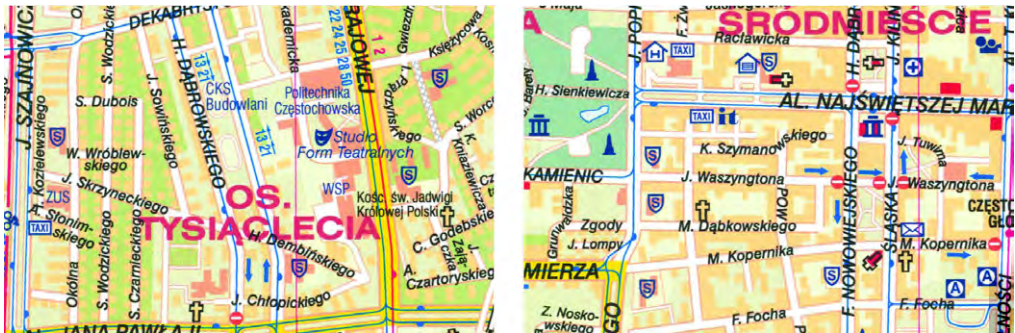

Fig. 8. The examples of the point symbols that were for the respondents: a) comprehensible – with description
on the maps; b) incomprehensible – with no description on the maps

same way to Set 1 with the smallest symbols, and to Set 5 with enlarged ones.

However, the study could not guarantee that reading the description of a symbol was tantamount to clear understanding of a sign symbolizing a topographic object. The respondents more often associated the location of a topographic object with the location of a description on the map, than with the location of a symbol. The naming layer was the only one all of the participants in the study noticed and understood in terms of linguistics. The respondents were able to read each description and understand its meaning, but they did not always understand its function.

It was significant that the respondents suggested replacing point symbols with circles with a number inside them, which they indicated as a sign naturally associated with an explanation placed outside the drawing of the map. A vast majority of the respondents did not have such associations in the case of the symbol-legend combination. The users did not use the legend function, nor did they begin reading the map by familiarizing themselves with its contents.

3.4. The interpretation of the drawing of buildings

With regard to the drawing of buildings, the study confirmed one of the well-known principle that the perception of a city map is largely determined by the degree of generalization and the colour used to

denote built-up areas. This does not change the fact that the drawing of buildings was for the study participants, in addition to point symbols, another serious problem of interpretation.

Maps showing buildings in a manner more generalized than in Set 1 were perceived as "clearer", "more legible", "more transparent". The respondents did not understand the drawing of buildings, and most of them could not interpret it. In extreme cases, a detailed drawing, such as that shown in Set 1, was considered by the respondents as real, defining it as a "bird's eye view" (Fig. 9a), or they came to the conclusion that Sets 2-4, in which the sign representing buildings retained its character (compact building arrangement, high and low scattered building arrangement), represent some completely hypothetical drawing (Fig. 9b). In contrast, the buildings represented in Set 5, in a maximum generalized way, were unnoticeable by the respondents who did not perceive it as a cartographic sign (Fig. 9c). Such problems as those described above were not observed in the case of another surface sign representing all green areas The colour of this sign was uniquely associated with an area covered with vegetation.

3.5. Colour preferences

The study of colours of city maps divided participants into supporters and opponents of specific combinations of colours. In general, the respondents unanimously emphasized that the colour used to represent building development should "harmonize" with the colours used to mark green areas, another element covering a large area on a city map. It should be emphasized that in this part of the interview the respondents were the most active, they formulated their opinions more readily and expressed them in a more decisive way than in the case of the other elements of the map.

Some participants clearly preferred the maps on which beige-brown-brick colours were used to represent the city's buildings. Therefore, these respondents preferred colours similar to those which for decades had been present on the Polish publishing market because of the cartographic monopolist, the National (later Polish) Enterprise of Cartographic Publishing Houses. City maps on which the drawing of buildings was represented using the colours mentioned above were referred to as made in the "traditional colours". Those respondents also decisively rejected the proposal for marking railway lines with a colour other than black, arguing against it with cartographic tradition.

The term "traditional colours" became a key word for a part of the research participants, it introduced positive emotions into the discussion, and the belief in the credibility of a map made in such a convention of colour was for those surveyed synonymous with professionalism (Fig. 10).

The identification of those who preferred "traditional colours" was the most valuable in this part of the study. An analysis showed that it was usually chosen by people who read the map fairly correctly. Unconventional colours, though at their first examination of interest to all of the respondents, were ultimately indicated by persons who at the beginning of the study were characterized by mediocre knowledge of the subject of the map and understood its content the least (Fig. 11).

Fig. 9. The interpretation of the of the graphic symbols of built-up areas by the respondents: a) "bird's eye view"; b) completely hypothetical drawing; c) built-up areas imperceptible by the respondents
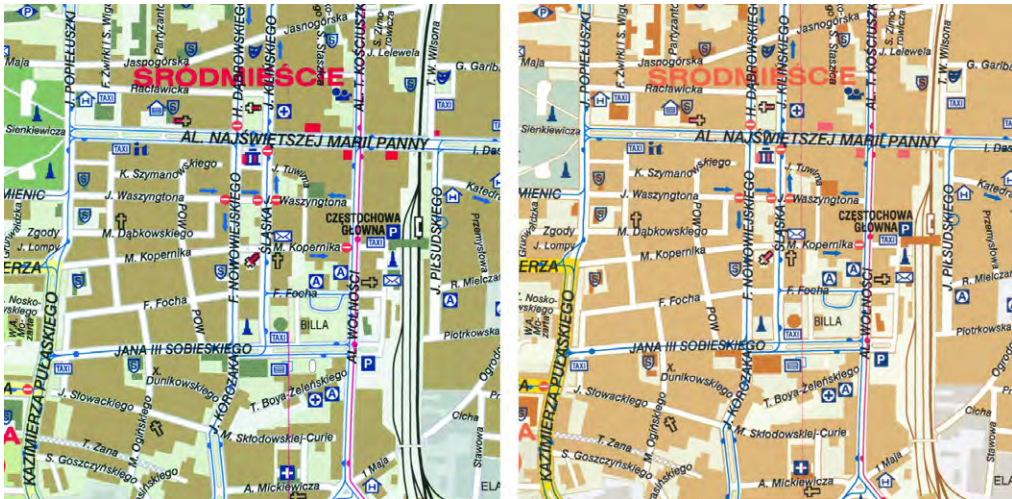
Fig. 10. The examples of colour schemes defined as "traditional colours" by the respondents, who read the map
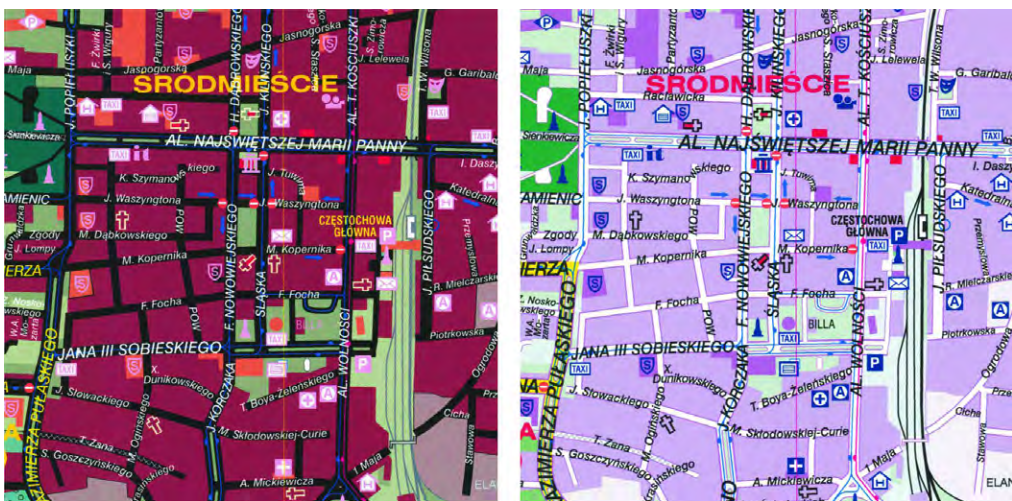fairly correctly

Fig. 11. The examples of colour schemes recommended by the respondents who read the map very poorly

3.6. The knowledge of terminology

Discussing the results of both these interviews one should also pay attention to the statements of the respondents regarding the use of geographic and cartographic terminology. Making their statements about city maps, the respondents had a large problem in formulating ideas, mainly because of the lack of terminology, familiarizing pupils with which is one of the tasks of teaching the basics of the science

of geography at the lower levels of education. Many respondents did not express their views using such words as "generalization", but when talking about the "accuracy of maps" they meant their detail, and they used words such as "transparency" and "clarity" to determine the legibility of the map. A map rendered illegible due to the information overload contained on it was in their nomenclature a "splattered map" or one which you would have to "pore over". A "legible" map is said to be in a "good

scale", because the scale of the map was associated by them with the legibility of its content. They believed that maps in a larger scale are more legible than those in a smaller scale. However, they permanently kept mistaking the notions of a "smaller scale" and a "larger scale".

Nonverbal messages, such as the way of "viewing" maps, "not noticing" the legend or symbols, combined with insufficient knowledge of appropriate vocabulary pointed to educational deficiencies in knowledge of the subject of geography taught at primary and secondary schools.

3.7. Using a sheet city map as an editorial form

The unfolding and folding of a sheet city map proved to be a great problem for the respondents. Although the city maps examined by them were folded in an unsophisticated way, folding them after inspecting them was a pretty big challenge for the respondents. Gestures made during unfolding and folding city maps, indicating helplessness and embarrassment, attested to the lack of frequent contact with this editorial form.

As resulted from the interview, users prefer those publications that reveal the drawing of a map upon pulling aside its cover, and it is from these copies that they make their selection. On the other hand, they reject those in which after drawing aside their covers the index of names or another text part of the map is shown. Admittedly, this behaviour results from the fear of destroying such a city map by unskilfully folding it. The fear of unskilfully folding a map prevents them from seeing the whole of its image. The respondents most frequently avoided unfolding city maps in the place where they purchased them. For this reason, the respondents preferred the city maps on which the image of a city, along with the index of its streets, could be found on one side of the sheet.

4. Conclusions

The conclusions presented in this final part of the paper refer to the set of research questions posed in the introduction and to the specific issues arising from the analysis of both studies, the primary one (including the city maps offered on the publishing market) and the complementary one (including the city maps in the form of prototype developments).

In answer to the first research question, it should be clearly stated that the users of city maps expect dedicated publications, with a content catering to their specific needs. The paradox lies in the fact that the expectations for topographic details that should be included in a city map as formulated by them by far surpass their perceptual capabilities and the ability to read maps; they clearly indicate that users desire to have the broadest geographic information on content of interest to them at their disposal, although it was also proved by the research that because of problems with reading maps they are not able to use it in practice. In addition, the studies showed that the concept of popular, universal city maps with a wide scope of topographic content does not meet the expectations of users and exceeds their perceptual capabilities.

In response to the second research question concerning the visualization of the content, it should be noted that, firstly, users of cartographic publications are burdened with the cultural code and prefer the colours of maps similar to those that have been offered in the last few decades on the publishing market by the largest Polish publisher – PECPH. Users associated this "traditional" set of colours with integrity and professionalism, which consequently resulted in a positive perception of the map. Secondly, the study participants had large problems with reading and interpreting symbols, especially point ones. Most of them did not associate symbols with the represented objects, whose descriptions contained in the city map were of greater effect. The only clues regarding the development of symbols that were obtained as a result of the research concerned taking into account the circumstances in which such a city map will be used. In contrast, the proposal to change point symbols into "numbers inside a circle", put forward by the respondents, proved to be important information. An analysis of these clues also provided material to formulate a response to the third, last, question posed in the introduction.

In an attempt to answer the last question asked in the introduction, i.e. in what way users' educational deficiencies in reading maps lead to losses in cartographic communication, it should be noted that the effectiveness of cartographic communication as

a form of social communication depends not so much on the graphic load of the image of a city map, but on the phenomenon of "functional illiteracy" in terms of reading it. This was demonstrated by both studies, especially the successive phases of the complementary interview, which showed what great difficulties reading a city map and using it as an editorial form can cause.

The primary study and the first phase of the complementary one further laid bare the actual, unfortunately very low, level of understanding of the content of a city map by persons taking part in the interviews. This part of the research led to grading most of the respondents as mediocre in this regard. The second phase of the complementary study made it possible to trace in the memory the start-up process of the knowledge acquired in the past, resulting in a significant increase in the efficiency of understanding a map. However, the lack of habit of starting to read a map from reading the contents of its legend and ignorance of geographic and cartographic terminology led to the search for the causes of these failures in educational deficiencies and insufficiently consolidated knowledge in the field of teaching geography in primary and secondary schools.

The above statements and specific issues that arose from an analysis of the research led to a broader reflection on the effectiveness of cartographic communication of city maps. In light of the foregoing conclusions it has to be stated that the most popular universal city maps are not a very effective form of social communication. The efficiency of information transfer, i.e. the reduction of losses in the efficiency of cartographic communication, may increase the selection of content for the needs of specific groups of users and enhance the close link between the visualization of a city map with the characteristics of the target group of users, especially with the circumstances in which they use this kind of map.

The results obtained were used to develop editorial principles for city maps, which the PECPH offered under the brand name of *Copernicus* (Fig. 12). The new developments were prepared in accordance with the research results. The publisher was not only successful economically, gaining in 2001 more than a half of the share in the cartographic market, but their city maps were found among the publication nominees for the emblem of "Poland Now" [Teraz Polska] (2002) and awarded the "Golden Emblem" of the Consumer's Laurels (2005) ["Złote Godło" Laur Konsumenta] as products and brands favourably perceived by Poles (Konopska, 2003; Konopska and Gotlib, 2006).
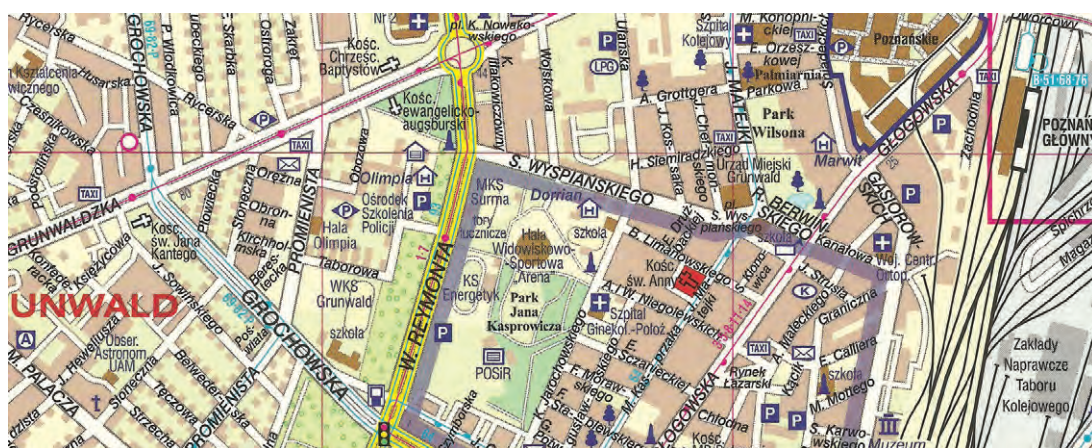
Acknowledgements

Fig. 12. The fragment of city map, which was made on the basis of the results of research

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Wykorzystanie wyników pogłębionego wywiadu grupowego w optymalizacji przekazu kartograficznego planów miast do użytku powszechnego

Beata Konopska
Instytut Geodezji i Kartografii, ul. Modzelewskiego 27, PL 02-679 Warszawa
Tel.: +48 22 3291900, Fax: +48 22 3291950, E-mail: beata.konopska@igik.edu.pl

Streszczenie: W artykule przedstawiono badanie planów miast metodą pogłębionego wywiadu grupowego oraz omówiono wykorzystanie uzyskanych wyników w optymalizacji skuteczności przekazu kartograficznego. Badanie wskazało preferowane przez użytkowników elementy treści planów miast wraz z ich formą graficzną oraz pokazało, w jakim stopniu braki edukacyjne w umiejętności czytania map wpływają na straty w przekazie kartograficznym. Wyniki badań wykorzystano do opracowania założeń redakcyjno-technicznych planów miast oferowanych pod marką *Copernicus* przez Polskie Przedsiębiorstwo Wydawnictw Kartograficznych im. E. Romera S.A.
Słowa kluczowe: plany miast, pogłębiony wywiad grupowy, optymalizacja przekazu kartograficznego, redakcja map