VISUAL PERCEPTION OF SIGNS OF TOURIST MAPS

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INTRODUCTION

The supply of cartographic production in the Lithuania market has been growing, since the restoration of state self-dependence. The improvement of special and economic conditions and open borders was a stimulus for development of tourism. It became the driving force in developing the cartographic production. The tourist cartographic production is supplied in a printed form – maps may be obtained in fuel station, tourist centers, and stores. It may also be found in journals, booklets or in a digital form. So far this information is most easily accessible on the Web but it may be expected to appear on the screen of mobile equipment in the nearest future. Not only the demand for general tourist maps has increased but also the interest in specialized cartographic production designed for tourist groups propagating a concrete kind of tourism.

The visualization of thematic information in tourist cartographic production of different publishing houses is varying. While the universal maps (e.g., road maps) use the more or less standardized signs, the specialized – advertising in particular – maps use signs created or freely chosen by each publisher. They give little consideration for the users of maps forgetting that signs should be informative, easily recognizable and correctly visually perceptible. The signs often are too sophisticated, have many meanings, and poorly represented the marked object. The varying marking of the same kind of objects or the use of the same signs for marking different objects is misleading and makes the reading of a map rather difficult.

The information should be presented in such a way that it is understandable not only for the compiler but for the user as well. The sings must have one meaning, easily readable and memorizable because, the user of a tourist map usually has no inclination to go into details of its legend. The article gives a classification of tourist maps, analyses the sign system and problems of their perception, and describes a concrete investigation of this kind and the results obtained.

TOURIST CARTOGRAPHIC PRODUCTION IN LITHUANIA

The old and modern maps have been and are designated for travelers. They help to orientate in the environment. No man can remember well the precise localization of all objects that interest him and easily orientate in a vast area. This was the main prerequisite for appearance of the first cartographic works. Today they may be regarded the first tourist maps. The appearance of tourist maps was preconditioned by appearance of tourism as a phenomenon. The developments of cartographic science and art and the increasing demands of the users of maps have influences the advance of tourist maps and tourism. The modern tourist map has developed under the influence of these factors (Fig. 1).

With the rapid development of tourism after World War II the tourist cartographic production became popular. There occurred a demand not only for general tourist maps but also for specialized cartographic production, i.e. for maps designed for certain groups of users. In the years of soviet power the themes, content and circulation of cartographic works were controlled by Moscow, and the publication of maps was limited. The cartographic production in Lithuania began its intensive development only often the restoration of state self-development. Lithuania has become open to foreign visitors the group of map users has increased.

The tourist cartographic production is presented in the analog form – such maps may be obtained in fuel-stations, tourism centers and stores and found in journals and booklets – and in the digital form – this kind of information is accessible on the Web. The character of information contained in the map in the analog and electronic form is almost the same. For these reason these maps are not analyzed as separate groups.

The terms “tourist cartographic production” and “tourist maps” are used within the semantic field of the following definition: tourist map is a semiotic spatial model (traditional or virtual) of real objects phenomena on the Earth surface designed to familiarize and help to orientate the traveler in a certain geographical space (after A. Woloditschenko).

Analysis of Lithuanian cartographic production, offered to tourist today, lies at the basis of its classification according to the type of information presented in maps and kinds of tourism (Fig. 2):
1) Universal maps – contain general tourist information; familiarize the users with tourist information of a territory (country, region, and city);

2) Specialized maps – present thematic tourist information orientated to a certain group of users. This group of maps may be divided according to the types of tourism info:
   a) maps of walking tourism – present special information about walking tours, camps, sight areas, etc.;
   b) maps of motor tourism – include supplementary information about fuel-stations, motor car services, interesting routes, distances between towns, etc.,
   c) maps of biking tourism – present information about bike rental, bikeways, interesting biking itineraries, picturesque places, etc.;
   d) maps of water tourism – present information about boat rentals and boat or yacht routes;
   e) maps designated for other kinds of tourism (country side tourism, air tourism, skiing, fishing, etc.);

3) Advertising tourist maps – the tourist information goes along with the advertising information. E.g., an interesting object for tourists is advertised and the way to this object is marked. The purpose of such maps is to raise interest of tourists in certain objects.

Some groups of maps included in the presented classification are partly superimposed. The suggested classification is not strict. Only the main types of maps published in Lithuania are presented and discussed. The maps and other branches of tourism are mostly published in different advertising issues or presented as sketch maps.

The development of tourism produces a considerable influence on the development and diversity of cartographic production. The influence of tourism and the cartographic production may be generalized in the following way.

Development of tourism:

- Stimulates the new trends of tourist cartographic production;
- Increases the demand of the traditional tourist cartographic production;
- Encourages to search for new ways of attractive introduction of a place on a map;
- Encourages the publishing of tourist maps in different languages;
- Gives an incentive to publish the cartographic production orientated to specialized groups of tourist;
- Stimulates the publishing of tourist cartographic production on the Web, creation of electronics maps, and maps on CD.

There is a that in the future state will plan development of tourism in the country and in separate region and will support the implementation of legal acts, regulating the business of tourism. This will help to create a modern and functioning system of tourist facilities fully supplied with tourist cartographic production.

**SPECIFIC CHARACTER OF SIGNS OF TOURIST MAPS**

The use of conventional signs is the main feature distinguishing maps from many other kinds of graphic models, such as: aero- and cosmic images, panoramas, and landscape views. Signs on a map represented visually perceptible elements conditionally introducing the process and phenomena of the surrounding world their location qualitative and quantitative characteristics, structure, dynamics, etc. (Berliant, 2002). Conventional signs are standard symbols used on maps to convey the type of an object, its location, size, qualitative characteristics.

The main functions of signs used on maps are: communicative, i.e., conveyance of certain information about object to map compiler or map user, and cognitive – helping to gain knowledge about the mapped object.
Fig. 2. Tourist maps classification
Today the use of conventional signs on maps allows to:

- Represent the real and abstract objects;
- Represent the invisible objects and objects, which cannot be perceived by sense organs;
- Represent the structure and intrinsic characteristics of an object;
- Reflect the interrelations of object: hierarchy, proportionality subordination, dissimilarities;
- Sow the dynamics of processes and phenomena;

Compactly depict objects and phenomena (Berliant, 2002).

In modern semiotics a sign is defined as: a material object perceived by sense organs, which participator in the process of cognition and communication as representing an object or a phenomenon, and is used for perception, storage, conveyance, and interpretation of information (Vostokova et al., 2002).

The signs are classified according to their constructional elements, formation principles, and complexity. There is no unifies classification of cartographic signs. There follows a survey classifications suggested by different researches.

A classicist of semiotic C.S. Peirce distinguished three types of signs – icon, index, and symbol. The icon resembles the indicated object, and symbol stands for on object by convention or rule (Fiske, 1998). A Russian cartographer Berliant also distinguished three types of signs:

- Abstract geometrical signs. The size of a sign represents the quantitative characteristics, the color or texture – the qualitative characteristics, and the structure of a sign does not represent the structure of an object;
- Textual signs – e.g. the letter “i” stands form information center; the letters “Al” – aluminum – stands for valuable natural resources; the size of a letter many reflect the quantitative parameters;
- Pictorial signs (pictograms) resemble the objects they stand for e.g. tourist tent – campsite. They are very picturesque and most often used in tourist and advertising maps (Berliant, 2002).

The mentioned Russian researcher Vostokova has suggested a similar classification supplemented with the forth type of signs:

Dynamic signs – moving, shimmering, and changing their size, form, color, or painting, signs, which are used on electronic maps.

American cartographers A. Robinson and J. Morrison apply the term “mimetic” for pictorial signs. They describe the signs in the following way: many cartographic symbols many be created using visual changing and basic graphic elements. There exists a multitude of symbols – form purely geometric (point, line, or area) to very vivid. Most of them resemble the objects they stand for. The pictorial symbols and the geometric symbols, which are clearly associated with the designated object, are called mimetic symbols (Robinson, Morison et al., 1995).

Professor A. MacEachren from the University of Pennsylvania classifies the signs into geometric, associative, and picturesque (MacEachren, 1995). The term associative is applied to the signs having an implied link with the denoted object.

On the basis of literary sources (Berliant, 2002, Fiske, 1998, Robinson, Morison et al., 1995, Mac Eachren 1995) and analysis of sings used on tourist maps the authors of the present work has developed the following classification:

Abstract signs. Signs created using abstract geometric figures.

Geometric signs. Signs created using geometric elements and in their form slightly resembling the denoted object.

Textual signs. Signs based on textual symbols.

Signs-symbols. Such signs in most cases are metaphor of the denoted object, i.e., the drawing does not resemble the denoted object.

Signs-drawings (pastiche signs). This group includes the signs, which fairly resemble the denoted object.

Mimetic signs. Photos are frequently used on tourist-advertising maps. For example a front-page photo, three-dimensional drawing, etc., may be used instead of conventional sign to denote a hotel. The perception of photo realistic sign is specific. Besides, its recognition depends on whether the respondent knows the object. For this reason this type of signs was not used in the present research.

The signs of the last three types are also called pictograms. The classification of signs is given in Fig. 3.

![Fig. 3. Classification of signs used in tourist maps](image-url)
The tourist maps are distinguished among other thematic maps in that the pragmatic aspect of their quality is more highly appreciated by the users. The convenience of signs (for reading and understanding) is one of the main criteria of evaluation of a map by the user. Moreover, the tourist maps are used by various groups, with set different demands for maps and in different ways evaluate the quality of and the same map.

As regards the icons in the general tourist maps it is especially important for the user to:

- Recognize the new without using the legend;
- Memorize the recognized signs;
- Quickly recognize the interesting places or router according to the sign groups;
- The signs must not impede the reading of the general information of the map and vice versa.

THE MAIN PRINCIPLES OF PERCEPTION OF CARTOGRAPHIC SIGNS

The signs are carriers of information. Yet, the perception of the information by the user depends not only on the form of presentation of the sign but on many other factors as well. The process of the rise of information presented in a map (communication process) may be described in the following way: a phenomenon is mapped, the data about it collected and interpreted by a cartographer (compiler), the product – map – is compiled, and the presented information is interpreted by the user (Sluter, 2001). This process has been applied in tourist maps. Fig. 4. shows the communication process of tourist maps.

All stages of communication process are affected by hindering factors, which may be denoted as interferences or noise. Under the effect of these factors the information is distorted in incorrectly perceived.

The inaccuracies and errors, which appeared while collecting the information about the mapped phenomenon, are pointed out at the first stage of communication ‘tourism’ and ‘data about tourist information’. The cartographer’s errors while interpreting the data appear as noise at the second stage of communication ‘data about tourist information’ and ‘interpretation of the data by cartographer’.

Cartographer’s errors made in the visualization of the information are shown as noise at the third stage of communication ‘cartographer’s data interpretation’ and ‘tourist map’. The user’s errors in perception of the presented information represent the noise at the fourth stage of communication ‘tourist map’ and ‘user’s data interpretation’. The interferences at the third and fourth stage of the process of communication were in the focus of the present research (Fig. 4).

![Fig. 4. ‘Noise’ in communication process (after Sluter, 2001)](image)

Two main tasks must be fulfilled in order to find out the processes and mechanism of perception of a map.

- Development of methods for different levels of investigated processes – perception of discrete signs, perceptions of the groups of sing, general perception of cartographic image;
- Evaluation of investigation results.

The investigations of visual perception of discrete signs must be based on a wide scope of experiments related with cartographic and psychological research. These experiments include: efficiency of graphic means, e.g., perception of
geometric figures differing in their form; evaluation of the choice of cartographic signs and print type; differences of colors spectrum; perception of signs in groups, etc.

The investigation may be carried in two ways:

1. Investigation of the perception of a group of isolated signs (not on a map, without taking into consideration the spatial relations between objects);

2. Analysis of readability and perception (recognition) of discrete signs on a real map with regard to color tones, superposition, and linear and areal marks (Vostokova et al., 2002).

The uttered and written words are simply perceived. We perceive the meaning of word without taking into account the real sound or physical expression of words. The perception of signs is based on something else. The signs are ‘not clear’. We pay attention to their appearance, distribution, and classification.

When we are reading or someone is talking to, communiqués are arranged in a consecutive order. Thus we are programmed to receive the flow of ideas in a certain defined order. It is the other way round with the visual information. From images one gets an optic impression synoptically (all at once) but not consecutively. The perception of each sign of a map depends on its position and appearance, i.e., it is related with all other signs on this map. On a map the information cannot be systematized consecutively as it is a speech written text. A map must be apprehended as a whole.

When we see a sight we perceive it. When we hear words or sounds we automatically try understanding them. We do this unconsciously with signs. As people tend to reject the visual monotonousness and unclearness the graphic images are systematized in such a way that they have visual meaning. Every sign is given such visual attributes as size, shape or color.

The graphic signs are perceived structurally. Some signs seem to be more important than others, some forms stand out, some colors dominate, etc. When these visual interrelations are perceived in the same way by compiler and user the communication is effective. If not, the map model is a failure.

According to established rules the signs-drawings bear the greatest resemblance with the denoted object (Dumbliauskienė, 2002) and they are called motivated signs.

It is a common view that the signs-drawings are perceived and memorized best, whereas the geometric signs – worst. Thus, we may state that the perception of signs increases linearly from geometric signs to drawings (hypothesis 1) (Fig. 9 hypothesis 1). The geometric signs are perceived worst. They are followed by sign groups according to complexity of visual constituents. Signs-drawings, photo advertising signs, signs 3D, etc. find themselves at the end of this scale.

The term ‘degree of associativity’ is applied by the author to define the resemblance of the sing with the denoted object. The ‘degree of associativity’ shows the link of the sign, with the denoted object according to the form and color.

The term ‘informativeness’ is applied for evaluation of the signs of tourist maps.

The ‘informativeness’ of the sign is defined by the scope of attributive meanings of the object the information about which is conveyed through the sign.

The evaluation of informativeness of a sign often is subjective in its nature. No unified system of methods exists for evaluation of informativeness in cartography. In our case the potential informativeness of the categories of signs is evaluated by comparison with the degree of ‘associativity’.

As some signs are more remote form the real meaning of denoted objects and others reflect the object rather realistically it would be natural to assume that degree of perception increases with the sign approaching the real form of the denoted phenomenon object (Fig. 9, hypothesis 2). Yet, the analysis of the dependence of informativeness on associativity
shows that the degree of perception falls down when the degree of associativity becomes to the high (Fig. 9, hypothesis 2). The over-associativity of the signs manifests through very sophisticated and polysemantic visualization of the object (phenomena and information load (the number of the conveyed abstract information).

The following hypothesis (hypothesis 2) of perception of signs is promoted:
The signs perception is functionally related with the degree of associativeness of the sign and linearly increases to a certain point. There occurs a ‘break’ in the scale of perception when the associativeness of the sign becomes too high. From the break point the perceptiveness of the sign begins to gradually decrease.

The present investigation of perception of tourist cartographic production was designed as a check if the mentioned hypothesis. The necessity of such investigations is pointed out by American scientist, cartographer R. Sluter: ‘for comprehensive conveyance of cartographic material it is very important to know the needs of map users (Sluter, 2001).

INVESTIGATION OF PERCEPTION OF SIGNS USED ON TOURIST MAPS

The number of respondents for the investigation was determined on the ground of literary sources (Kardelis, Sapagovas, 1998, Kardelis, 2002). Fifty respondents were chosen for the inquest. The group of respondents was formed by the simple method of random choice. The necessary number of respondents was randomly selected form the population list, provided that the features of the selected groups of respondents reflect the features of the whole population (Kardelis, 2002). As the chosen population included the working people the group was proportionally composed of 24 men and 26 women (The proportion of men and women in the population of Lithuania is 1000 to 1121. The Yearbook of Lithuanian statistics, 2000).

The inquest was carried out using questionnaires. They included five general questions (about the age, sex, education, using of maps) and 40 signs of varying graphic form used on tourist maps. The respondents were asked to indicate the implied meanings of signs in 10 minutes.

The experimental group included respondents, who often consulted tourist maps.

According to visuality and conveyed information the signs were divided into five groups: abstract signs, geometric signs, textual signs, signs-symbols, signs-drawings (pastiche).

The investigation was designated to determine:

- Degree of perception of signs used on tourist maps;
- Individual perception of sign groups by respondents;
- Perception of signs by men and women;
- Perception of signs groups by respondent of different age groups.

The results obtained were processed by statistical methods – variation analysis (ANOVA test, LSD post hoc criteria test) and cluster data analysis (method of hierarchy) (Čekanavičius, Murauskas, 2002).

For calculation of distances between the sign groups in cluster the square Euclidean metric and Ward’s method were chosen.

Analysis of results

By ANOVA test the differences between the average values of sign groups – recognition of signs according to the number of error (frequency) – were evaluated. It was determined that the differences between all groups of signs – according the number of errors – were statistically significant (p<0.001).

The LSD post hoc criteria test helped to evaluate the confidence level of statistical significance of difference between each group of signs and the remaining groups.

Table 1. Reliability of difference between the groups of signs, %

<table>
<thead>
<tr>
<th></th>
<th>Abstract</th>
<th>Geometric</th>
<th>Textual</th>
<th>Symbols</th>
<th>Pastiche</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbols</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>&gt;99.99</td>
<td>&gt;99.99</td>
</tr>
<tr>
<td>Pastiche</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

The obtained results show that the probability of errors statistically significantly differs between all groups of investigated signs (p<0.001).

The percent of unrecognized signs in each group of signs was determined. As had been predicted the geometric and least pictorial signs were recognized worst.
Fig. 6. Percent of errors in recognition of different sign types

It was also investigated how the signs are recognized by men and women and by different age groups of respondents. Two age groups were distinguished: aged 16-40 and 40-60 (as was already mentioned the population is represented by working people).

The LSD post-hoc criteria test for different sex groups revealed that the differences of recognition of all types of signs are statistically significant. The results were different for men and women. Women made 28% of mistakes and men – 34%.

By the same methods a general evaluation of recognition of signs was done for different sex and age groups of respondents. The obtained results are given in Fig. 7.

Fig. 7. Percent of errors in recognition of different sign types by different groups of respondents

The difference between respondents of two age groups is not statistically significant ($p = 0.161$). Errors of recognition made 30% in the age group 16-40 years and 33% in the age group 40-60 years.

Different sex and age group of respondents applied the LSD pos hoc criteria test in calculating the recognition of each separate group of signs. The results are given in Table 2.

The cluster analysis was employed for investigation of sign types as recognized by different groups of respondents. The results obtained are given in Fig. 8. According to calculation results textual and drawing-like (pastiche) signs are most comparable by recognition. They are followed by signs-symbols. Abstract and geometric signs comprise a separate group (cluster) of worst recognition.
### Table 2. Percent of errors by different respondent groups across different sign types

<table>
<thead>
<tr>
<th>Sex Age</th>
<th>Signs</th>
<th>Not recognized, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Women</td>
<td>16–40</td>
</tr>
<tr>
<td></td>
<td>Abstract</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td>Geometric</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>Textual</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Symbols</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Pastiche</td>
<td>25</td>
</tr>
</tbody>
</table>

Fig. 8. Similarity of sign types by recognition across different respondent groups

The obtained results showed that recognition of sign types by age groups of women followed the similar pattern in the general signs types recognition cluster (Fig. 8). The differences occur only in distances between sign groups. In the groups of men the most similar by recognition are textual signs and symbols followed by drawings. The abstract and geometric signs comprise a separate cluster (more remote form the first group).

The general sign recognition by respondent groups followed the pattern: the highest similarity of sign recognition was characteristic of men in both groups of respondents closely followed by women of age group 16–40. Women of 40-60 represented the most distinctive group of recognition.

**Evaluation of results**

Two hypotheses were formulated at the initial stage of investigation:
- Recognition of signs is in direct proportion to the strength of their association with the denoted object;
- Signs of simple structure, which do not directly resemble the denoted object but are associated with it, are most easily recognized and memorized; form a certain point the resemblance with the denoted object reduces its memorization.

The mentioned hypothesis and the results of investigation are shown in Fig. 9.
The obtained results proved the second hypothesis that the signs of average associativity are most easily recognized. Thus, the textual and graphic symbols in tourist maps should replace the popular pictorial signs for higher efficiency. Here it must be emphasized that symbols are very specific in their character. One cannot expect that unaccustomed signs will be easily recognized and memorized.

The performed investigation does not pretend to be an exhaustive study. The dependence of sign recognition on age, sex, and sign type was evaluated without taking into consideration, many other (though not so easily evaluated) factors, e.g.: the frequency of use of tourist maps, individual experience of respondents, relative frequency of use of each sign on tourist maps published in Lithuania, the diversity of signs denoting the same objects, etc. This was an experimental investigation, which showed that there exist statistically reliable methods of checking the suitability of signs to be used on various types of maps.

The presented results may be helpful in compiling maps – visualization of thematic information using more easily recognized signs – and conducting similar investigations designed to reveal the needs and distinguishing features of perception across different groups of society.

**CONCLUSIONS**

The signs used in tourist maps are classified into five groups: abstract, geometric, textual, symbols and pictorial (pastiche). On the ground of this classification the ratio between the associativity (graphic resemblance with the denoted object) and potential informativeness was evaluated. By statistical methods the break point of quick recognition of the signs was found. It means that above a certain level of associativeness the perception of signs ceases to improve and even begins to reduce.

The hypothesis developed on theoretical basis was verified across statistically different groups of users and proved correct (p< 0.001). It may be also assumed to be correct in general.

It is recommended to retain optimal ratio between the visualness of the sign and its informativeness on universal tourist maps. The signs with average associativity are most suitable for this purpose. The sophisticated signs, which visually resemble the denoted object, are not very functional.

The recognition of signs was the subject of the present investigation. There are other aspects of sign pragmatics related with the context, spatial structures, fashion, etc. More detailed investigations would lead to a broader conception of sign pragmatics. It could be at the basis of development of sign systems for concrete maps.

**REFERENCES**