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# NON-VISUAL PERCEPTION OF LANDSCAPE – USE OF HEARING AND OTHER SENSES IN THE PERCEPTION OF SELECTED SPACES IN THE CITY OF POZNAŃ

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**Abstract.** Perception of landscape is associated with the perception of space first of all by the sense of sight. Visual perception is supplemented by sensations collected by the other senses. The aim of the conducted investigations was to identify landscapes in the city of Poznań perceived both positively and negatively, using the senses of hearing, smell and touch. The questionnaire method was applied in this study. It was determined that for most respondents a decisive role in the perception of landscape, apart from sight, was played by the sense of smell and hearing.

**Key words:** non-visual perception, multi-sensory landscape, senses, hearing, the sense of smell, the sense of touch

## INTRODUCTION

In recent years the problem of the perception of the environment (landscape) has inspired interest in specialists from different fields of science – psychology, physiology, ecology, geography, sociology, urban planning and landscape architecture. Each of these disciplines considers the essence of perception differently – from the point of view of its field, thus contributing to the creation of many theories, techniques and methods investigating this interdisciplinary phenomenon [e.g. Bartkowski 1985, Kowalczyk 1992, Krzymowska-Kostrowicka 1995, Pietrzak 1998].

It is commonly assumed that perception is a complex cognitive process comprising both the reaction of the human beings to phenomena and stimuli of the outside world and the processes occurring within their organisms [Encyklopedia powszechna PWN 1987].

The issue of perception was presented in detail by Krzymowska-Kostrowicka [1995], in whose opinion the term perception refers to a set of stimuli – information reaching the brain and transformed in it into sensations, images, associations, etc., determining the behaviour of the organism. A factor determining the

response to stimuli is connected with the specific process of association and comparison of the perceived reality with patterns recorded in memory – either encoded genetically or acquired in the course of the learning process.

People collect information from their surroundings using their senses – sight, hearing, smell, taste and touch, they consciously or subconsciously recognise, compare, classify, assess and evaluate them, undertaking specific actions.

Sight is the most dominant sense in humans and its loss is connected with consequences of many limitations in various fields of life. Thanks to the so-called surrogate representations connected with the sense of touch and hearing (e.g. sound, surface texture, etc.) limitations resulting from visual impairment may be minimized and key information may be obtained concerning the immediate surroundings. Apart from the sense of touch, through skin we also sense pressure, changes in temperature (warmth and cold), pain and vibrations. Instead of the everyday term „the sense of touch" we should use "skin sensations" instead. Humans perceive sound signals from approx. 20 to 20 000 Hz, thanks to which they may sense threats, their position and evaluate a situation in which they are found [Budny 2008]. Sounds trigger different impressions, pleasant ones including birds singing, hum of the sea, rustle of the forest, water, trees, while unpleasant include noises caused by cars and industrial machines as well as wind. Also the sense of smell may be used as a system aiding in navigation and orientation in the surroundings. Smells are highly varied and have a chemical background, to which human cells react selectively; aromas fill space, the range of an aroma is dependent on the concentration, velocity of air movement and efficiency of the sense of smell [Kowalczyk 1992]. Appropriately selected aromas may also be strongly acting stimuli in aromatherapy. Taste is inseparably connected with the sense of smell. Thanks to tastebuds located mostly on the tongue humans are able to distinguish found basic tastes, i.e. salty, sweet, bitter and acid.

Perception capacity of the organism may be attributed to two contexts, the first (*episteme*) covering such perception properties such as the perceived distance towards an object, objectivisation, formalisation, while the other (*techne*) is connected with the perception of closeness, sources of stimuli, specificity or subjectivity of contact. On this basis Ong [1977] ordered senses into the following sequence: (*episteme*) ← sight – hearing – smell – taste – touch → (*techne*), which in the psychological aspect is limited to two extremes: „seeing" – is knwoing, „touching" – is feeling. The system proposed by Ong reflects the actual order of importance of stimuli both in the behavioural and cognitive sense, while the most important is visual perception, determined first of all by the cognitive process of information processing, while in relation of *techne* stimuli it is somatic [Krzymowska-Kostrowicka 1995].

Most generally perception is a complex process for the perception of reality, particularly the surroundings, space within the range of senses: sight, hearing, smell, taste and touch. A significant effect on perception and evaluation of sur-

roundings is played by interests and acquired experiences as well as factors of somatic and socio-cultural as well as physical and mental character. This results in the selectiveness of perception, consisting in the fact that we selectively accept certain elements, while omitting the others.

Somatic factors of perception include:

– the state of the vegetative system, managing the functioning of life functions of the human organisms, controls the state of its stress in the process of perception;

– animal reactions, consisting in the identification and assessment of sensory stimuli and as a consequence their generalisation concluded with the development of an evaluation in the categories of good and evil, benefit and threat;

– biopsychological reactions – being a result of relations between psychology and biology, i.e. the condition of the psyche, mood, emotional attitude and the physical condition of the organism [Kożuchowski 2005].

Moreover, it needs to be stressed that humans see the world not directly, but rather through the prism of culture, of which they are members and which they are creating. Culture has developed factors differentiating the character of perception, such as historical and cultural traditions, the system of knowledge acquisition, the position occupied in the social structure, as well as moral, esthetic and innovative sensitivity, etc. Thus socio-cultural determinants of perception may be divided into several groups, remembering however that in the reality of the mind they are combined and they overlap, providing as a consequence a coherent outlook, valuation and comprehension of the observed phenomena or objects [Krzymowska-Kostrowicka 1995].

In the process of perception of the natural environment, particularly landscape, visual stimuli constitute a predominant portion of signals from the environment. In studies and analyses of landscape first of all visual methods are used, e.g. the method based on architectural and landscape units (JARK) and architectural and landscape interiors (WAK) developed by J. Bogdanowski [1994], the graph of the curve of sensations by K. Wejchert [2008], the theory of landscape drawing by M. Pietrzak [1995]. The visual perception of landscape is supplemented by sound, smell, tactile and taste stimuli. The amount of information reaching the human consciousness from individual senses may not be accurately measured; however, it is known that their role in the perception of landscape is varied and changeable. The sensory perception of the surroundings, in the opinion of psychologists is composed of four elements [Sperling 1995]:

– sensory stimuli originating from the perceived elements of the surroundings,

– the background, vicinity, environment, in which the perceived elements, attracting attention, are located,

– previous, preceding moments of perception, sensory experiences (perception inertia),

– personal feelings, attitudes, inclinations, expectations and objectives.

A subjectively created image of landscape, created as a result of sensory perception of stimuli – signals absorbed from the environment, has been termed the multi-sensory landscape. Bartkowski [1985] defined it as a reflection of sensory signals absorbed from the natural landscape in perception. In an opinion of Sperling [1995] it is a new quality, reflection, but not a copy, rather a comprehensive, subjective experience, forms, shapes, melodies and scenes organised in the mind into a reasonable entity. In turn, according to Kowalczyk [1992], the multi-sensory landscape is an objectively existing structural and territorial reality (in the geographical sense), perceived by senses (in the psychological sense); it is a brachylogy for the concept of landscape perceived by the senses of sight, hearing, smell and touch.

Pietrzak [1998] evaluated multi-sensory landscape referring to it as experiencing the landscape scenery. In the analysis of landscape scenery the following criteria are assumed: beauty, diversity, natural character, orientation, stimulatory character and family-oriented nature. In turn, in the non-visual experiencing of landscape the focus is on such aspects of contact with the environment as:

– possibility to use landscape (e.g. outdoor activities, angling);
– touching and movement of different objects ( e.g. tree bark, flowers);
– smells (e.g. herbs, hay) and sounds (e.g. singing of birds, rustle of leaves);
– thermal regulation of the organism (e.g. basking in the sun, cooling in water);

as well as the role of factors disturbing perception (e.g. noise, unpleasant smells).

Studies conducted at the Department of Green Areas and Landscape Architecture, the Poznań University of Life Sciences in Poznań aimed at the indication of the importance of the senses, except for sight, in the perception of space.

## MATERIAL AND METHODS

The conducted investigations were based on an example of the city of Poznań and its immediate environs. In order to collect results questionnaires were used, in which open and semi-open questions concerned non-visual perception of space in Poznań and its environs. Respondents were asked to indicate places characterised by specific sounds and smells perceived as positive or negative and to explain the nature of these sounds and smells. The next part of the questionnaire referred to touch stimuli, the respondents were asked to indicate places, which activate the sense of touch and to explain what sensations connected with this sense were recorded in the above mentioned places. Moreover, they were asked to indicate which senses apart from sight are of greatest importance at the perception of space (possible responses: hearing, touch, smell, taste, balance, others – please indicate which). A question was also placed in the questionnaire, concerning feelings connected with the functioning of the sense of touch in space (six possibilities were listed concerning the perception of space by the sense of touch and the respondents were asked to indicate others).

The group of respondents comprised 90 individuals. Among them there were 41 people aged up to 30 years and 19 individuals aged over 30. Moreover, 15 respondents were either blind or with visual impairment (all aged over 30) as well as 15 deaf individuals were included in the study (5 aged up to 30 years, 10 over 30). The sex of the respondents was also recorded in the questionnaire. Some of the respondents are not inhabitants of Poznań, but all respondents declared sufficient knowledge of the city and its environs to participate in this study.

The survey was conducted by 5-th year students of Landscape Architecture among their acquaintances and relations. Contact with the deaf respondents was provided by the Association of the Deaf "Ton", while with the blind and individuals with visual impairment – by the Polish Association of the Blind, District of Wielkopolska.

Analyses presented below are pilot scale studies. Their results will make it possible in the future to construct another questionnaire, containing closed questions, which will make it possible to include a greater number of individuals in the survey an at the same time ill ensure lesser scatter of responses.

Results were analysed using the Excel spreadsheet.

## RESULTS

Responses to the questionnaire comprise a total of 965 responses, of which 434 concerned locations in Poznań and its environs (282 responses indicating placed perceived as positive and 152 perceived as negative) as well as 531 responses concerning factors being stimuli for the senses (322 concerning factors with a positive role and 209 – those with a negative role).

The responses indicated a total of 131 specific locations in the city and its environs as well as 113 factors perceived with the senses.

The most important senses for the non-visual perception of space indicated by the respondents included the sense of smell (a total of 66 responses) and hearing (62 responses); however, it needs to be stressed that 15 respondents were deaf. The next selected sense was the sense of touch (35 responses), balance (11 responses) and taste (4 responses).

Places most frequently indicated as attractive in terms of their perception with different senses (fig. 1) included green areas around Lake Maltańskie (a total of 29 responses) and the Old Town (31 responses), particularly the Old Market (27 responses among 31 indicating the Old Town). Generally very high value in terms of sensory perception was mentioned for green areas within the city limits and in its immediate environs (149 responses). Apart from Lake Maltańskie the most commonly mentioned places included the Cytadela park (18 responses), Lake Rusałka (15) and a wood Lasek Marceliński (13). Jointly 24 locations associated with green areas, situated within the city limits and 4 located outside the city were mentioned.

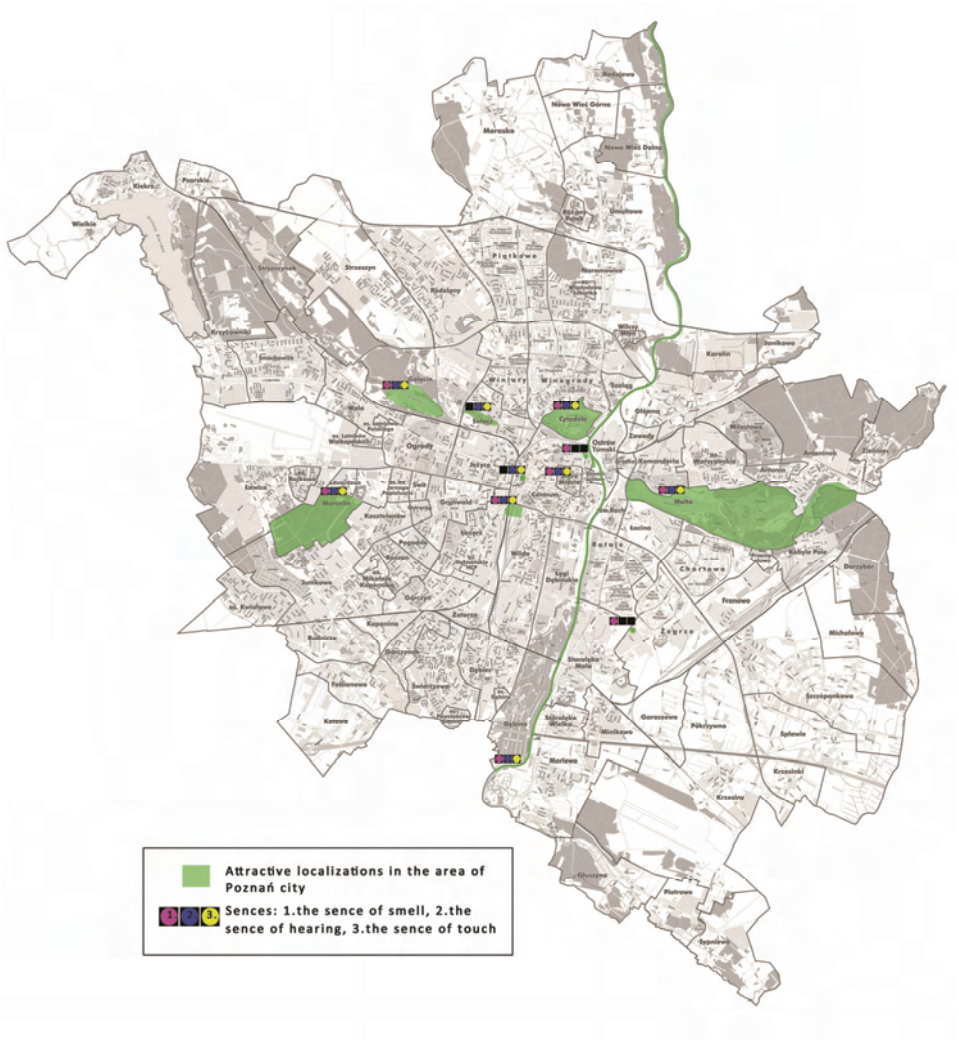


Fig. 1. Locations in Poznań, indicated as attractive in the perception with the senses of hearing, smell and touch (resources: map of Poznań www.zdm.poznan.pl/news.php?site=sim&sub=10, edited by Daria Łabędzka)

Ryc. 1. Miejsca w Poznaniu określane jako atrakcyjne przy użyciu zmysłu słuchu, węchu i dotyku (źródło: mapa Poznania www.zdm.poznan.pl/news.php?site=sim&sub=10, oprac. Daria Łabędzka)

The most frequent responses mentioning particularly unpleasant locations (Fig. 2) indicated the sewage treatment plant (a total of 33 responses, including 17 indicating the sewage treatment plant in Wilczak and 14 – the plant in Koziegłowy). The perception of many locations in the city centre (54 responses) and the Main Railway Station (10 responses, probably not influenced by the currently conducted extension works on that object) was defined as negative.

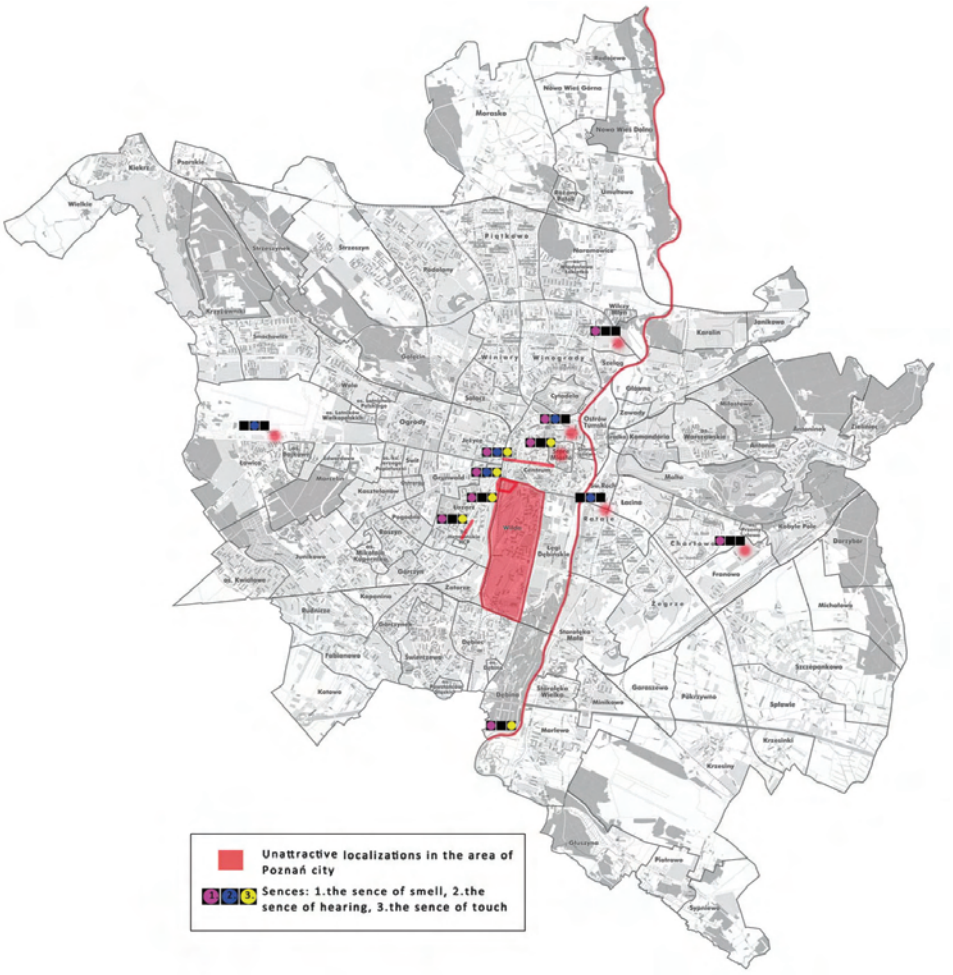


Fig. 2. Locations in Poznań, indicated as anattractive in the perception with the senses of hearing, smell and touch. (resources: map of Poznań www.zdm.poznan.pl/news.php?site=sim&sub=10, edited by Joanna Micińska)

Ryc. 2. Miejsca w Poznaniu określane jako atrakcyjne przy użyciu zmysłu słuchu, węchu i dotyku (źródło: mapa Poznania www.zdm.poznan.pl/news.php?site=sim&sub=10, oprac. Joanna Micińska)

Apart from responses indicating specific places perceived positively or negatively by the senses, analyses were conducted also on the responses given by the respondents concerning factors affecting the senses (tab. 1). The most frequently mentioned perceived as positive comprised a group of natural factors (179 indications). These included e.g. weather factors (34 responses, including wind 26, rain 3, sunlight 3, dew 2, moisture 1), stimuli connected with the presence of vegetation (a total of 66 responses, e.g. touch and smell of grass 22, rustle of trees 13, smell of flowering plants 11) and animals (a total of 47 responses, including e.g. birds singing – 36). Sensations connected with contact with water

were also mentioned as very positive (a total of 20 responses, including 10 responses concerning fountains in the city). Moreover, a considerable proportion of respondents, mainly young people, considered sensations connected with being in the urban space as positive, e.g. the hustle and bustle of the city (9 responses, including 7 by young people), and noises connected with railway transport (13 responses). Factors considered negative most frequently were defined as stimuli connected with vehicles (a total of 67 responses, e.g. the hum of cars 23 responses, exhaust fumes 13 responses, noise of trams 11 responses) as well as the noxious odour of the sewage treatment plant (30 responses). Sensations connected with pleasant aromas of food proved to be very important (48 responses).

Table 1. Responses concerning factors influencing non-visual perception
Tabela 1. Odpowiedzi dotyczące czynników wpływających na niewidzialną percepcję

| | Total number of responses Sumaryczna liczba odpowiedzi | Groups of factors Grupy czynników | Number of responses Liczba odpowiedzi | % | Selected factors Wybrane czynniki | Number of responses Liczba odpowiedzi | % |
|---|---|---|---|---|---|---|---|
| Factors evaluated as positive Czynniki ocenione jako pozytywne | 322 | natural naturalne | 179 | 55.6 | weather | 34 | 10.6 |
| | | | | | connected with plants | 66 | 20.5 |
| | | | | | connected with animals | 47 | 14.6 |
| | | | | | connected with water | 20 | 6.2 |
| | | urban miejskie | 70 | 21.7 | hustle of city | 9 | 2.8 |
| | | | | | railway | 13 | 4.0 |
| | | | | | smell of food | 48 | 14.9 |
| Factors evaluated as negative Czynniki ocenione jako negatywne | 209 | natural naturalne | 0 | 0 | - | 0 | 0 |
| | | | 77 | 36.8 | hum of cars | 23 | 11.0 |
| | | | | | ehaust fumes | 13 | 6.2 |
| | | | | | sounds of trams | 11 | 5.3 |
| | | | | | odour of sewage treatment plant | 30 | 14.4 |

Analysis of responses contained in the questionnaire shows that among places attractive for the **sense of hearing** the most frequently mentioned places were green areas (a total of 26 responses) and the Old Town (14 responses related with the hustle and bustle of the city, sounds from cafes, etc.). The positive factors stressed by the respondents were first of all sounds connected with nature. These included e.g. birds singing (36 responses), rustle of trees (13 responses), splash of water (including the sound of fountains 10 responses), wind (7 responses). In the group of younger respondents pleasant sounds included the hustle of the city (8 responses) and surprisingly, noises connected with traffic, first of all trains (13 responses) and trams (5), or even the hum of cars (3 responses). At the same time sounds connected with traffic lanes and transport

were evaluated as negative (the sound of cars 23 responses, trams 8 responses, airplanes 8 responses, trains 4 responses, the signal of an ambulance or the fire brigade 4 responses).

In terms of positive sensations perceived by **the sense of smell** the respondents mentioned particularly green areas (a total of 37 responses). Such locations were listed as Lasek Marceliński (6 responses), Park Szelągowski (5 responses), the Botanical Garden, Park Wilsona, the areas at Lake Maltańskie and Park Cytadela (4 responses each). Another important group of mentioned objects included industrial plants, producing food and emitting smells perceived as pleasant (a total of 31 responses). Within this group the most frequent answers mentioned the coffee-roasting plant at Garbary Street (15 responses) and a bakery at Unii Lubelskiej and a chewing gum factory at Obodrzycka (4 responses each). Industrial objects perceived as negative due to the emitted smells included a brewery, a tire manufacturing plant as well as abattoirs located near Poznań, fuel terminals and a dairy. The aroma of foodstuffs or their components were indicated as a factor 48 times. The smell of coffee was mentioned most frequently (19 responses), followed by the aroma of bread and confectionery (13 responses). Moreover, the respondents mentioned as positive stimuli for the sense of smell (a total of 47 responses) such natural smells as the smell of spring, forest, meadow, grass, flowering plants, trees, cereals, water, dew ad wind. The most frequent examples in that group included the smell of flowering plants (16 responses) and mowed grass (11 responses). Unpleasant smells were first of all the odour in the vicinity of the sewage treatment plant (mentioned 30 times as a stimulus, among the specific locations the sewage treatment plant in Wilczak was mentioned 14 times, while the plant in Koziegłowy was mentioned 13 times). Among other specified locations perceived as unpleasant due to their smell the city centre (6 responses) and the Main Railway Station (5 responses) were given as examples.

In the section of the questionnaire concerning **the sense of touch** a question was asked on the sensations through which space is perceived using this sense. Six possible responses were listed (a gust of wind, texture of pavement, the feeling of warmth/cold, crowd, drops of water from a fountain, vibrations in the ground) as the respondents were asked to add others (among them rain and sunlight on the skin were mentioned). The most frequently selected responses included the texture of pavement (44 times) and the feeling of warmth/cold as well as gusts of wind (43 times each). The other ways in which space is perceived with the sense of touch were indicated less often: drops of water from a fountain (30 times), crowd (26 times), vibrations in the ground (22 times), sunlight on the skin (3 times) and rain (2 times).

Pleasant sensations perceived with the sense of touch were associated with green areas (a total of 38 responses) e.g. around Lake Maltańskie (15 responses), at Lake Rusałka (6 responses) and the Cytadela park (5 responses). Pleasant factors perceived in these locations included a gentle breeze (14 responses),

going over a natural gravel pavement (10 responses) and walking barefoot on the grass (12 responses). Moreover, drops of water falling from a fountain were indicated as a positive factor 10 times. The fountain in front of the Opera House (Teatr Wielki) in Poznań was indicated 6 times as a pleasant location because of this factor. The Old Market was also perceived positively, mainly due to the sensations connected with walking over a cobbled pavement and drops of water from the fountains located there. The unpleasant factors perceived with the sense of touch were mentioned to be uneven pavements (11 responses), dirt (9 responses), as well as congested streets and public transport (9 responses). Mainly locations in the city centre were mentioned as particularly unpleasant places due to the above mentioned factors.

## DISCUSSION

Survey studies conducted by Pietrzak [1998] showed that the properties of landscape most preferred by respondents included its utilitarian character – conditions for bathing, outdoor games and picking of forest fruits (taste); having physical contact with flowers, grass and water (the sense of touch). The most appreciated aroma in landscape is the smell of fresh air and herbs. The most important sounds in landscape are considered to be birds singing, the hum of water and streams. Results of pilot scale surveys conducted in the city of Poznań and its environs confirmed the importance of urban green areas, providing conditions for active recreation and a positive opinion on the natural stimuli in the urbanised environment.

Analyses of conducted studies clearly indicate considerable individual variation in sensations connected with the perception of space with different senses. This is indicated by the scatter of responses and variation in responses between individual groups of respondents. Many locations and factors were mentioned in the responses of individual people in extremely different ways. An example here may be provided by the perception of such stimuli as the sound of vehicles or the smell of mint chewing gum produced in the plant at Obodrzycka street. Both these factors received both negative and positive opinions (given by different people). The perception of individual factors may be determined by their intensity. It is the case with the wind, which was mentioned as a pleasant factor 26 times and unpleasant – 2 times. Perception of some factors depends also on the seasons of the year ("gentle spring wind"). It seems that extremely different evaluation is possible for individual locations depending on the weather, season of the year, or even the attitude of the respondents, as well as their traits and sensitivity. The manner of perception of individual factors as negative or positive was influenced e.g. by age. In the group of the younger respondents (up to 30 years of age) stimuli characteristic of urban space were perceived as positive, such as sounds connected with traffic (trains, trams, buses, cars, airplanes), the

hustle and bustle of the city, music in the streets, bells. The same factors, e.g. the hum of cars, the hustle and bustle of the streets were perceived as negative by the older respondents (over 30 years of age).

No distinct differences were found in the responses given by the disabled respondents and by those sing all the senses. The only differences reported were connected with the fact that the blind respondents stressed the importance of feelings related with moving over different types of pavements. Additionally, a specific factor was additionally mentioned in this groups, not mentioned in the other questionnaires, i.e. sounds of traffic lights at zebra crossings.

## CONCLUDING REMARKS

Landscape supplies not only visual stimuli, but also affects (through smells, sounds, touch – the so-called non-visual perception) other senses. According to the Visual Landscape Design Training Manual [1994] the sense of sight collects 87% stimuli from the environment, hearing – 7%, the sense of smell – 3–5% and taste – 1% [Pietrzak 1998].

In case of studies conducted in Poznań it turned out that apart from the sense of sight in the perception of landscape a particularly important role is played by the sense of smell – 37.1% and hearing – 34.8%, followed by the sense of touch – 19.7%, balance – 6.2% and taste 2.2%. Among the factors having a positive effect on the senses the respondents mentioned those of natural character (55.6% responses), while their negative effect was not mentioned. The positive character of urban factors (21.7%) was indicated much less frequently, while their negative perception (36.8 % responses) was stressed.

In view of the conducted studies it seems that when designing available public urban space, especially recreation areas, it is advisable to use and preserve natural value of the environment, since they have a positive effect on perception. Since no marked differences were shown in the responses given by the disabled (the deaf, the blind) and those using all the senses it may be stated that esthetic value is not the most important criterion in the perception of landscape. Moreover, when in contemporary cities people are being increasingly attacked by the visual media it is worthwhile to refer to the concept of multi-sensory landscape, creating gardens and paths of senses, which may be of particular importance in making available space and providing education to the disabled [Szczepańska i Ogonowska-Chrobrowska 2010, 2012].

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## NIEWIDZIALNE PERCEPCJE KRAJOBRAZU – WYKORZYSTANIE SŁUCHU I INNYCH ZMYSŁÓW W POSTRZEGANIU WYBRANYCH PRZESTRZENI W POZNANIU

**Streszczenie.** Postrzeganie krajobrazu związane jest przede wszystkim z percepcją przestrzeni zmysłem wzroku. Percepcja wizualna wspomagana jest poprzez inne zmysły. Celem badań była identyfikacja krajobrazu miasta Poznań, postrzeganego zarówno pozytywnie, jak i negatywnie przy użyciu słuchu, węchu i dotyku. W tym celu przygotowano kwestionariusz. Dla największej liczby respondentów decydującą rolę w percepcji krajobrazu, oprócz wzroku, stanowił zmysł słuchu i węchu.

**Słowa kluczowe:** niewidzialne percepcje, multisensoryczny krajobraz, zmysł słuchu, zmysł węchu, zmysł dotyku