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Sensory gardens as places for outdoor recreation adapted to the needs of people with visual impairments

Abstract. The article addresses the question of adapting public spaces, including parks and gardens, to the needs of people with disabilities for the purpose of outdoor recreation. According to the principles of universal design, public spaces should enable social inclusion, which implies respect for current needs of diverse populations. The study described in the article focuses on the needs of people with vision impairment regarding outdoor recreation and adjustments that need to be made in the infrastructure of parks and gardens. The aim of the study was to answer three key questions: (1) How can outdoor experiences be made accessible to people with visual impairments? (2) How can outdoor experiences be encouraged, rethought and redesigned for people with visual impairments? (3) What barriers stop people with visual disabilities from participating in outdoor leisure in sensory gardens? These questions are answered using insights from desk research, data from an inventory of selected sensory gardens and interviews with blind and partially sighted respondents. The study, conducted between June and August 201, covered 15 gardens located in various parts in Poland: in cities, rural areas and areas of natural value. The interviews, involving 32 respondents, were held directly in the gardens in cooperation with the Polish Association for the Blind. The results were used to formulate recommendations for good practice in the field of universal garden design, which can provide sensory experiences for everyone, including people with visual impairments. The observed development of sensory gardens seems to reflects a great interest in this type of outdoor sites, which are conducive to recreation, education, integration, and social inclusion. Solutions applied in sensory gardens should provide inspiration for creating universal gardens, accessible to everyone.

Keywords: sensory gardens, outdoor recreation, people with visual impairments, people with disability, universal design

JEL Codes: Q01, R53, R58

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1. Introduction

Outdoor recreation, with its many benefits (i.e. relaxation, education, health, integration), can have a very positive effect on the person's psycho-somatic condition, which is enhanced when recreation takes place in green areas, including parks and gardens, especially those designed with a multisensory effect in mind. These so-called sensory gardens foster perceptions and experiences other than optical ones, which makes them particularly attractive as place of outdoor recreation for people with a visual disability (PwVD). The way they are designed can provide a blueprint for universal design of outdoor recreation areas.

Up until now, the needs of people with disabilities (PwD) have not necessarily been considered when planning areas of outdoor recreation. In order to implement more inclusive solutions in outdoor recreation areas it is necessary to obtain feedback from people with disabilities regarding their experiences, needs, and – especially – already tested, recommended practices. The study described in this article focuses primarily on the needs of people with vision impairments regarding outdoor recreation and adjustments that need to be made in the infrastructure of parks and gardens. Key research problems are expressed in the following questions:

Q_1 – How can outdoor experiences be made accessible to people with visual impairments?

Q_2 – How can outdoor experiences be encouraged, rethought and redesigned for people with visual impairments?

Q_3 – What barriers stop people with visual disabilities from participating in outdoor leisure in sensory gardens?

The analysis of the empirical study is preceded by a review of the literature, addressing specific facets of outdoor recreation for PwVD, ideas and concepts associated with the creation of sensory gardens and universal design. The next section (Data and methods) includes a detailed description of research problems related to the three research questions and information about the scope of the study and the research methodology. The third section is devoted to the analysis of the results. The part regarding the inventory of gardens includes information about (1) elements facilitating spatial information, (2) infrastructure facilitating the mobility of blind and partially sighted persons, (3) techniques for communicating information to blind and partially sighted people in sensory gardens. Information collected during the interviews with blind people made it possible to recognise: (1) the role of the senses in individual perception and spatial orientation, (2) the role of the senses in spatial orientation in a given garden, (3) the possibility of moving independently (spatial orientation and safety) in a known environment; in a new, unknown environment; in a sensory garden, (4) facilitation of

spatial orientation in a given sensory garden, (5) factors contributing to the sense of security in a given sensory garden, (6) favourite, most interesting places in a given sensory garden, (7) barriers and restrictions hindering sightseeing or stay in a sensory garden. In the discussion of the research results the authors highlight beneficial changes that improve convenience for PwVD, i.e. thanks to universal solutions in the form of screen readers, audiobooks, etc. The study also shows the need to change the stereotypical point of view, whereby information needs of blind people are limited to Braille inscriptions, since the ability to use this alphabet – especially among the younger generation – should not be taken for granted these days. The article ends with conclusions referring to the three research questions, which provide useful guidelines for universal design of outdoor recreation taking into account the needs of PwVD.

2. Literature review

People with visual impairments encounter many difficulties in free outdoor recreation. Studies conducted among young people by Jessup, Cornell and Bundy [2010] have shown that "Young people who are visually impaired have fewer social interactions with friends and are more likely to spend their free time alone. They are involved in less varied and more passive activities, have less independence, and are usually accompanied by their parents. Their out-of-home activities are more likely to be structured than spontaneous" [Jessup, Cornell, Bundy 2010: 419]. Sometimes surrounded from childhood by excessive care, and often extremely cautious themselves, they do not fully benefit from the rest and leisure activities, although the benefits are similar for people with and without visual deficiencies [Bashir, Bano, Sajan 2014]whereas, some leisure activities require only substantial mental effort such as playing chess and painting a picture. These physical and mental activities also overlap too much. School is place where the students with visual impairment can enhance their physical, mental emotional, social skills by which they can adopt the changing conditions of the progressive world. In this study the efforts have been made 1. Later in life, engaging in leisure activities becomes a challenge for PvVD, since even their daily activities take more time because of their disability [Berger 2011]. Given the complexity of disability, as well as its social aspects, disabled people struggle to 'have fun' and meet social expectations regarding engagement with outdoor play even if their real feelings are mixed or even unambiguously negative [Horton 2017] widely circulated discourses about the value of outdoor, natural play for children overwhelmingly marginalize the experiences of families with disabled children, who can often experience outdoor/natural play as a site of hard work, heartache,

dread, resignation and inadequacy. This paper presents findings from research with 60 North London families with children aged 5-16 who have a statutory 'Statement of Special Needs'. Focusing on these families' experiences of visiting designated, newly refurbished accessible natural play-spaces in two local country parks, the paper highlights: (i. Many are afraid of the social stigma associated with disability and therefore try to conceal it [Goffman 1963]. The same strategy – minimising the visibility of the disability – is often used by PwVD when they do not want to stand alone in a public place and would like to be seen as competent spatial actors. Other strategies to achieve this goal involve using a guide dog or a white cane [Worth 2013]. They need a safe, trusted space that they can use independently, to have a good time without assistance from others and social coercion, and be able to satisfy their natural curiosity and acquire new information.

Sensory gardens, or more broadly – all gardens, can be used for this purpose and often serve as a natural background for therapy. Horticultural therapy "includes interventions mediated by nature-oriented views and spaces such as gardens and everything associated with them, the plants and material related to them, garden tools and garden occupations performed among disabled people for healing and for restoring or improving health and well-being or for rehabilitation or simply for general benefit" [Söderback, Söderström, Schälander 2004: 245]. There are three ways to engage in horticulture: interaction, action, and reaction [Relf 1981]. A garden can be the place of active (when doing something) or passive (just being there) therapy [Latkowska, Miernik 2012]. Outdoor activities undertaken in gardens (like walking, playing, sunbathing) can be interpreted differently. Hagedorn [1988] regards them as passive uses of a garden, while for Gonzalez and Kirkevold [2015], they are active forms of using this space. The therapeutic influence of being in a garden seems to be stronger when the visitor has a bond with the place and uses it actively [Adevi, Mårtensson 2013]. Even a visit to a small garden can bring relaxation and joy, and if the space is well-designed, it can be not only a place of therapy but also of mental relief. Nowadays, therapeutic outdoor spaces can be found anywhere, as their positive impact is widely known, but historically the first healing gardens were planned especially for patients in hospitals or other health care centres [Finlay 2018; Reeve, Nieberler-Walker, Desha 2017]. The origin of sensory gardens is very similar. The idea of a sensory garden – or rather a field of sensory experience, originally came from Hugo Kükelhaus. He designed a space in which there were different stations demonstrating various physical laws but also forcing visitors to confront their own inner world, prompting them to use their senses to perceive the world. The idea was to learn through the body [Luescher 2006]. In the field of sensory experience designed in line with Kükelhaus' assumptions, visitors should be able to experience the space i.e. through their feet, by walking on different kinds of surfaces, prefer-

ably barefoot; through their ears, listening to the sounds of various instruments, gongs, bells, buzzers etc.; through the contrast of light and shade; through scent, touch, swaying etc. [Lotz 1997].

According to Pawłowska, every garden is in some way a sensory garden because the surrounding reality is perceived with all senses [Pawłowska 2008: 143]. Regardless of the creators' intentions, any garden is a place where scents, tastes, and tactile sensations are combined in a unique pattern. Sensory gardens are very diverse; some depend on interactive toys; others are characterised by rich vegetation; still others have a special educational value.

Based on the above review of the literature, it is possible to list a few key features of an ideal sensory garden:

– it must be designed with a certain purpose in mind;
– it should constitute a closed whole, separated from the surrounding space;
– it should stimulate all human senses;
– it should focus on non-visual experiences;
– in addition to vegetation, it should also have other stimulating elements [Dąbski, Dudkiewicz 2010; Gonzalez, Kirkevold 2015; Hussein 2009; Sensory Trust 2003; Szczepańska et al. 2013; Ujma-Wasowicz, Fross 2014].

Because the notion of 'a sensory garden' has not been clearly defined, visitors do not always know what is hidden behind this concept. There seems to be a need for more precise descriptions. A very similar need for some kind of management regarding the granting of special status, and perhaps even certification, can be observed in the case of so-called 'healing gardens', which also lack any formal specifications [Cooper Marcus 2016]. It should also be remembered that sensory gardens are not the only form of providing sensory experience in open spaces. Dąbski and Dudkiewicz [2010] distinguish:

– Sensory gardens as independent areas,
– Sensory paths providing sensory experiences, but also involving movement and opportunities to learn orientation skills and discover one's own abilities,
– Enrichment of open landscapes implemented in diverse and easily accessible areas to make them suitable for developing the entire sensory range [Dąbski, Dudkiewicz 2010: 8].

Each of the above categories requires a certain level of accessibility to serve its purpose. The first factor that needs to be taken into account is safety and easy orientation. For PwVD, the most important aspect during a visit to a garden is comfort and safety. The next crucial factor is the ease of access. Things, such as species diversity or the garden size are less important [Woźny, Lauda 2004]. A clear and simple design of the garden paths makes them easy and comfortable to use. The paths should have rounded corners and should not be obstructed by

any free-standing elements, such as benches or flowerpots, which should be located near them; the use of contrasting colours is also recommended. If possible, railings should be placed in the garden to help blind people find their way around. It is also advisable to mark the central spot of the garden to facilitate orientation. This can be a building, a signpost or a fountain. All the paths must have curbs to prevent PwVD from coming off the path and to facilitate orientation. Variety is the key to success: paths, walls and fences with various types of surface can significantly help visitors find their way. In order to make plants more accessible to people with visual impairments, they should be placed in beds located 50-90 cm above ground level. It is also a good idea to plant and sow plants with characteristic features, e.g. with flowers, fruits, stems or leaves of interesting, unusual shape [Latkowska 2009; Dąbski, Dudkiewicz 2010; Woźnicka, Janeczko, Nowacka 2014; Pudelska et al. 2015].

There are major shortcomings regarding the adaptation of public facilities and spaces for PwVD, since in many countries, including Poland, disabled persons are still mainly associated with wheelchair users [Wysocki 2012]. It is also extremely difficult to determine what solutions should be applied in public spaces, as "people with visual impairment rely on a personal and unique combination of sensory inputs to produce an organised and meaningful understanding and awareness of the spatial experience of public spaces" [Jenkins, Yuen, Vogtle 2015: 8651]. It means that every user perceives a garden in their own, unique way, and each person may need a different adaptation, especially when they have multiple disabilities. That is why, in many cases, instead of introducing special design features to adapt spaces to the needs of people with disabilities, it is more reasonable to follow the principles of universal design. The term, coined in the 1970s, refers to the practice of designing products and environments in such a way so that they can be used as much as possible by people of all ages and abilities without further adaptation [Connell et al. 1997; Story, Mueller, Mace 1998; Wysocki 2012]. According to Żółkowska [2016], one drawback of universal design is the fact that it does not take into account the complex cultural, social, political relationships and processes taking place within the geographical space, institutions and management systems [Żółkowska 2016: 75]. All these factors must be considered when discussing general accessibility of green outdoor spaces. First of all, the best strategy is not to create a space for people with disabilities, but rather with them, listening to their comments and needs. This is the best way of implementing the idea of universal design [Zajadacz 2015; Zajadacz, Lubarska 2019]. Secondly, no garden will become popular with visitors if certain conditions are not met: adequate seating, shading, and greenery are essential to make a garden attractive [Pasha 2013; Dos Santos, de Carvalho 2012].

3. Data and methods

The purpose of the study was to answer three fundamental questions (Q), which are elaborated in the form of specific research problems (P):

Q_1: How can outdoor experiences be made accessible to people with visual impairments?

(P_1) elements facilitating spatial information,
(P_2) infrastructure facilitating the mobility and stay for blind and partially sighted people,
(P_3) techniques for communicating information to blind and partially sighted people in sensory gardens.

Q_2: How can outdoor experiences be encouraged, rethought and redesigned for people with visual impairments?

(P_4) the role of the senses in individual perception and spatial orientation,
(P_5) the role of the senses in spatial orientation during a visit to a garden,
(P_6) possibility of moving independently (spatial orientation and safety) in a known environment; in a new, unknown environment; in a given sensory garden,
(P_7) facilitation of spatial orientation in a given sensory garden,
(P_8) factors determining the sense of security in a given sensory garden,
(P_9) favourite, most interesting places in a given sensory garden

Q_3: What barriers stop people with visual disabilities from participating in outdoor leisure in sensory gardens?

(P_{10}) barriers and restrictions hindering sightseeing, stay in a sensory garden.

To answer Q1, inventories were made in 15 sensory gardens, located in different parts of Poland. Field research was conducted between June and August of 2018. The garden inventory was based on assessment criteria presented in the study of Jakubowski, Szczepańska and Ogonowska-Chrobrowska [2018]. Data concerning Q2 and Q3 were collected during interviews with respondents with visual impairments of various types and levels, which were conducted directly in the gardens. Among 32 respondents, mostly members of the Polish Association for the Blind, were 19 women and 13 men, ranging from the age of 9 to 68 (in the case of 9 respondents aged 9-17, interviews were conducted with the consent of their guardians), from large cities and medium-sized towns. The questionnaire included the same set of questions as those used by [Wysocki 2010] to enable comparisons.

The respondents' levels of visual impairment varied: 9 persons (28.1%) were completely blind, 2 persons (6.3%) had only light perception and 21 persons (65.6%) were partially sighted (with 15 persons utilising the remaining sight

constantly, and 6 persons utilising the remaining sight only with favourable circumstances such as proper illumination, high colour contrast, right time of day). 16 persons were blind or partially sighted since birth, 14 persons had lost sight as a result of an illness, and 2 persons – following an accident. The group also varied in terms of the level education (primary: 10, vocational: 6, secondary: 13, university: 3). Almost half of all respondents were not able to read Braille (15 persons, 46.9%); among the others, 5 (15.6%) only had a basic knowledge of the alphabet, 3 (9.3%) – average knowledge, and 9 (28.1%) claimed to be proficient.

4. Results

To answer the question: '**How can outdoor experiences be made accessible to people with visual impairments**' one needs, among other things, to identify **elements that facilitate spatial information** in the sensory gardens under study. The results of the inventory indicate that the most common elements and conveniences include scents, clear path layout and varied types of path surface (Table 1). These infrastructural features are not targeted at a small minority of visitors. Quite the opposite, they are integral qualities of parks and gardens.

Table 1. Elements of sensory gardens that facilitate spatial orientation

No.	Feature	Number of gardens with this feature	Percentage of gardens with this feature
1.	Clear path layout	12	80.0
2.	Paths with rounded corners	4	26.7
3.	Tactile walking surface indicators	0	0
4.	Various types of path surface	11	73.3
5.	Waypoints described in Braille	4	26.7
6.	Audible information	2	13.3
7.	Spatial models	0	0
8.	Scents	15	100.0
9.	Mobile applications	0	0
10.	Assistance from others	9	60.0

Gardens: 1. Bucharzewo, 2. Owińska, 3. Zawoja, 4. Bolestraszyce, 5. Osmolice, 6. Trzcianki, 7. Bród Nowy, 8. Kraków, 9. Gdańsk, 10. Lublin, 11. Muszyna Ogród Zmysłów, 12. Muszyna Ogród Biblijny, 13. Muszyna Ogród Magiczny, 14. Poddębice, 15. Powsin PAN Ogród Botaniczny CZRB (Warszawa).

Source: Field inventory conducted between July and August 2018.

When adequately implemented, these features can help to create a place where PwVD can also rest and enjoy recreation.

Regarding the **infrastructure to facilitate the mobility and stay for blind and partially sighted people**, the most common infrastructural elements included the use of various surface types, tables, elevated flowerbeds and ramps (Table 2). Such conveniences can be treated as part of default outdoor area development and are beneficial to all users.

Table 2. Infrastructure to facilitate the mobility and stay of blind and partially sighted people in selected sensory gardens

No.	Feature	Number of gardens with this feature	Percentage of gardens with this feature
1.	Site plan	4	26.7
2.	Tables	8	53.3
3.	Curbs (as guides)	5	33.3
4.	Railings	7	46.7
5.	Elevated flowerbeds	8	53.3
6.	Ramps	8	53.3
7.	Various surface types	11	73.3

Gardens: 1. Bucharzewo, 2. Owińska, 3. Zawoja, 4. Bolestraszyce, 5. Osmolice, 6. Trzcianki, 7. Bród Nowy, 8. Kraków, 9. Gdańsk, 10. Lublin, 11. Muszyna Ogród Zmysłów, 12. Muszyna Ogród Biblijny, 13. Muszyna Ogród Magiczny, 14. Poddębice, 15. Powsin PAN Ogród Botaniczny CZRB (Warszawa);.

Source: Field inventory conducted between July and August 2018.

The most commonly used **techniques for communicating information** to blind and partially sighted visitors in sensory gardens included sensory paths and interactive toys, tactile graphics and tactile plans, enabling sensory experiences and learning through practice and providing an attractive way to spend free time in an open air space for all kinds of visitors. Options specially designed for blind people include information boards with descriptions in Braille (Table 3).

To answer the question **'How can outdoor experiences be encouraged, rethought and redesigned for people with visual impairments?',** it is necessary to identify the **role of the senses in individual perception and spatial orientation**. The questionnaire results indicate that blind and partially sighted visitors relied on the sense of hearing (15), touch (9), on visual memory (4) and remaining sight (4), and on the sense of smell (1) and balance (1). The respondents also rated the degree to which each sense was useful in collecting information when moving about and for spatial orientation in everyday life (Fig. 1. situation A), and then rated their usefulness during a visit to a sensory garden (Fig. 1. situation B).

Table 3. Ways of providing information to blind and partially sighted people in sensory gardens

No.	Feature	Number of gardens with this feature	Percentage of gardens with this feature
1.	Braille/Large Print information boards	7	46.7
2.	Braille/Large Print guide	1	6.7
3.	Touch-and-audio information boards	1	6.7
4.	Interactive website / Voice guide/ Audio description	1	6.7
5.	Tactile graphics / Tactile plans	5	33.3
6.	Sensory path / Interactive toys	11	73.3

Gardens: 1. Bucharzewo, 2. Owińska, 3. Zawoja, 4. Bolestraszyce, 5. Osmolice, 6. Trzcianki, 7. Bród Nowy, 8. Kraków, 9. Gdańsk, 10. Lublin, 11. Muszyna Ogród Zmysłów, 12. Muszyna Ogród Biblijny, 13. Muszyna Ogród Magiczny, 14. Poddębice, 15. Powsin PAN Ogród Botaniczny CZRB (Warszawa).

Source: Field inventory results, July-August 2018.

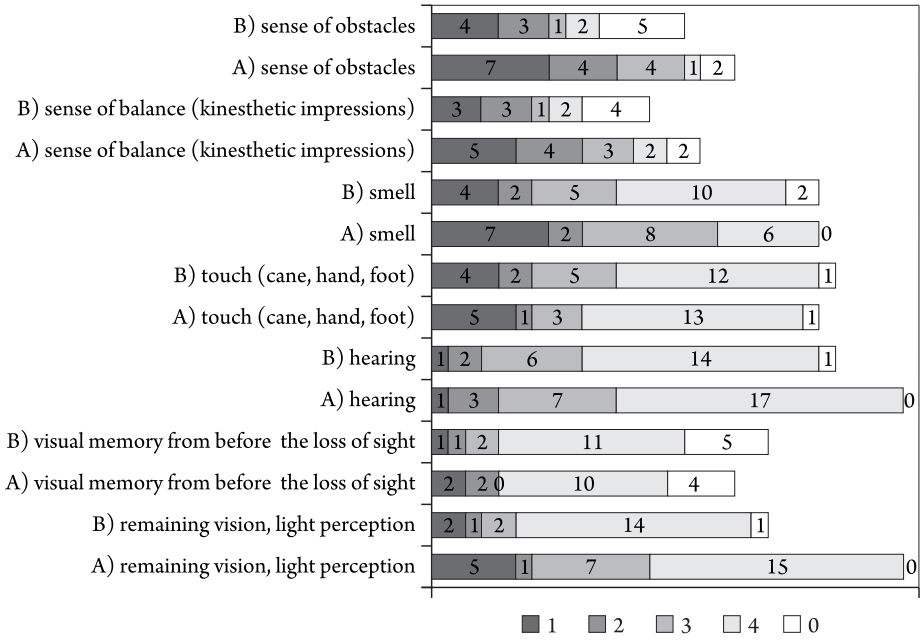
Based on these answers, it can be concluded that the most important senses include:

– hearing and sight (light perception),
– touch (cane, hand, foot) and visual memory.

The other senses (smell, balance and obstacle sense) play a less important role.

The role of the senses in spatial orientation during a visit in a garden is represented in Figure 1 (situation B). When asked to compare everyday spatial orientation (A) with orientation in a sensory garden (B), the respondents reported a more frequent reliance on the sense of smell and more balanced use of other senses with less reliance on the sense of hearing, which suggests that in a safe, predictable arrangement of a garden, accompanied by a number of balanced stimuli, the sense of hearing is not as crucial as in everyday life and can enjoy a certain degree of rest thanks to the holistic exposure to other surrounding stimuli.

Respondents' assessment of **the possibility of moving independently (spatial orientation and safety) in a known environment**; **in a new, unknown environment and in a given sensory garden** varied (Fig. 2). The possibility of moving independently requires a good knowledge of a specific area. While blind or partially sighted people can move independently in a well-known area, spatial orientation in a new environment is difficult without help from other people. However, thanks to the way they are designed, layouts of sensory gardens are relatively easy to learn.



Importance assessed on a 4-point scale: 1 – the least important, 4 – the most important, 0 – no opinion.

Fig. 1. The importance of senses in spatial orientation (A – overall, B – in sensory gardens) according to blind and partially sighted respondents

Source: Interviews with garden visitors [$n = 32$].

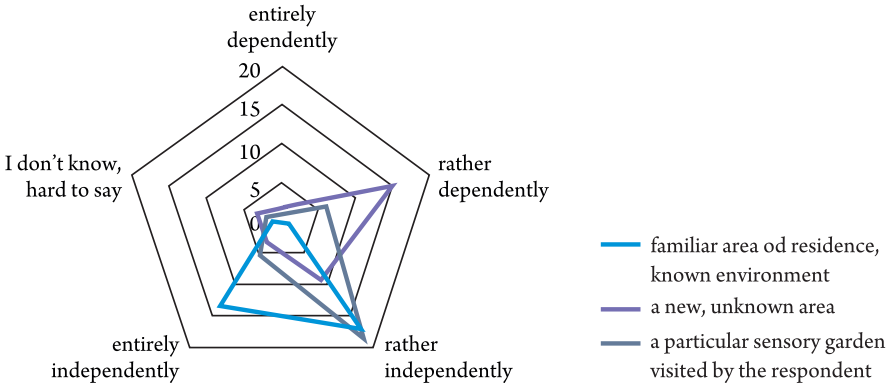
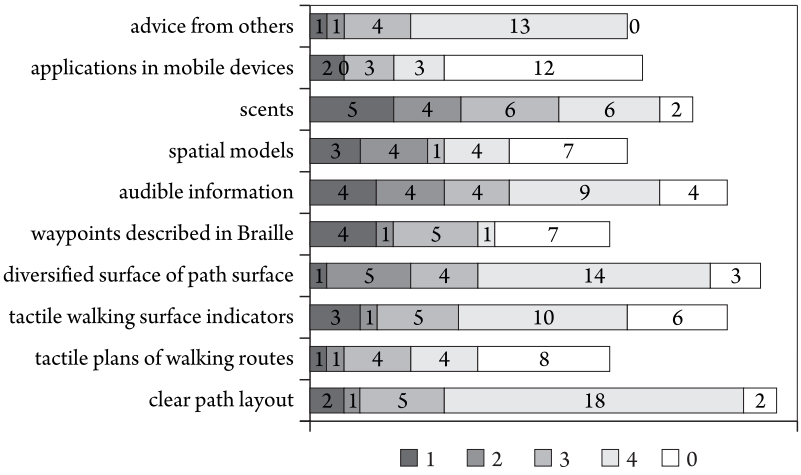


Fig. 2. Possibility of moving independently according to blind and partially sighted respondents

Source: Interviews with garden visitors [$n = 32$]



Importance assessed on a 4-point scale: 1 – the least important, 4 – the most important, 0 – no opinion.

Fig. 3. Factors that facilitate spatial orientation in sensory gardens according to blind and partially sighted respondents

Source: Interviews with garden visitors [$n = 32$].

Asked to list **solutions that facilitate spatial orientation in a given sensory garden,** the respondents mentioned the following**: intuitive path layout, various path surfaces, assistance from other people, textural markings on paths, and voice information.** Less commonly listed factors included smells, models and paths with rounded corners (Fig. 3).

Another questions concerned **factors contributing to the sense of security in a particular sensory garden.** The three most important factors mentioned by the respondents include:

(1) spatial order of the garden, proper development of the area (16 pers.): secure path edges; intuitive paths layout, clearly marked paths (with yellow tapes), various path surfaces; roofed resting spots; railings, balustrades; fences, safety nets; absence of dangerous elements, e.g. sewer grates; well-maintained paths, safety measures near water reservoirs;

(2) presence of other people (15 pers.): i.e. friends, security officers, garden employees, guides for PwVD;

(3) safety equipment (7 pers.): stable and sturdy safety appliances, the use of a cane, security cameras, illuminated paths, emergency buttons to call for help.

Asked to list their **favourite, most interesting places in a particular sensory garden**, the respondents mentioned things that can be touched, smelled and heard, such as:

1. Plants and animals – that can be touched, picked, smelled and tasted (e.g. beans, carrots, strawberries); e.g. an area with herbs; smells – the presence of plants, water, animals, which can be touched, such as rabbits (12 answers);

2. Resting places: bridges, alleys, gazebos, playgrounds, squares for safe bicycle riding, benches near water, lake, or a fountain (14 answers);

3. Devices – possibility to use springboards, swings, sound stairs, carousels, balance beans, climbing walls, acoustic zones (i.e. dulcimers, organs), mechanical experiences zones, touch zones, water walls (10 answers).

The respondents found sound, touch and smell sensations such as those listed above to be the most important sensual experiences in a sensory garden.

The question '**What barriers stop people with visual disabilities from participating in outdoor leisure in sensory gardens?**' is connected with the problem of identifying **barriers and restrictions hindering sightseeing, stay in the sensory garden.** 11 (out of 32) respondents gave an affirmative response to the question 'Do you encounter obstacles with using city parks and gardens?'. The main obstacles mentioned in the survey can be grouped according to the classification proposed by Agovino and others [2017]:

1. Cultural obstacles: bad manners – sighted people who fail to provide assistance regarding spatial orientation to the blind; danger posed by bicycle riders; obstacles located on paths, patchy pavements, hooligans;

2. Environmental obstacles: uniform path surfaces, non-intuitive paths layout making spatial orientation harder, unsafe corners, lack of landmarks, obstacles one cannot walk over like felled trees and branches; unsafe bridges over water pools, garbage, lack of bathrooms, uneven surface of paths;

3. Informational obstacles: lack of information board, lack of audio guides, lack of entrance signs, exit signs, path layouts, etc.; complicated path layouts.

The survey was also an opportunity to learn about respondents' **expectations concerning the design of parks, gardens, city spaces taking into account the needs of blind and partially sighted people.** Respondents pointed out principles that should be followed and convenience measures that should be implemented in all parks and gardens (e.g. city gardens) to meet the expectations of PwVD. Based on their feedback, it is possible to list several categories, such as:

1. Spatial order – garden arrangement that ensures good spatial orientation and safety: safe path edges (rounded corners, grass), various path surfaces, tactile indicators, tactile plans, even and well-maintained paths, railings in front of slopes, street signs (for example prohibiting bicycle and rollerblade riders from entering paths used by PwVD), clean paths without foliage or fallen trees and branches, good quality surfaces (even, stable, non-slippery), contrasting colours, dangerous spots marked with bright yellow paint (edges, thresholds); clearly labelled movement direction, entrances and exits, maps with large fonts, good illumination, security cameras;

2. Customised information system: sounds, audio description, Braille alphabet markings, enlarged print, tactile elements of the surroundings, models;

3. Universal resting places: outdoor gyms, benches, recreational spots, umbrellas to hide from the sun, customised bathrooms.

By exercising their concentration skills, blind and partially sighted people can better recognise surrounding stimuli. **As representatives of PwVD community indicate, audio messages are preferable to touch-based inputs.** Braille information got low ratings because few respondents were sufficiently familiar with it. This confirms the observation made earlier that **information for PwVD should also be available in forms other than the Braille alphabet, such as, for example, protuberant writing and audio messages**.

5. Discussion

What is not obvious but what is revealed by the results, is the need to supplement the inventory with the possibilities offered by new technologies. They were almost entirely overlooked in our study but nowadays prove to be a very effective and convenient means of helping PwVD to find their way and obtain information about visited places and their special qualities [Siu 2013]. There is also the question of how to choose a method of providing information. Our study shows that people with visual disabilities are reluctant to rely on information provided in Braille, and, besides, there is relatively little information available in Braille anyway. Braille reading is considerably slower than listening and print reading, for physiological and cognitive reasons. Fingertips have a very limited area of contact with the text compared to the eyes; moreover, the contact is successive and sequential, while in visual reading much more information is taken in simultaneously [Baciero, Perea, Gomez 2019; Paterson 2016]. This is one of the reasons why it is easier to understand a printed text containing mistakes or jumbled letters than its Braille version [Perea et al. 2015]. To sum up, print reading is about three times faster than tactile reading; listening to audio messages is somewhere in between, but with the help of modern technology enabling users to increase playback speed, audio recordings can match the speed of print reading [Paterson 2016]. There are, however, other issues connected with tactile texts. An experiment conducted on Braille users confirmed that the physical quality of a given text (the height of the dots) affects the reader's certainty and reading speed [Lei et al. 2019]. Moreover, only few PwVD can actually read Braille. In the UK, for example, only an estimated 1% of blind people use Braille. The supply of content in Braille exceeds the demand from users, and new generations are not taught Braille, as they increasingly rely on auditory tools, as well as smartphones and screen reading software [Rose 2012]. The best solution

would be to use both auditory and Braille information, as already mentioned, but if only one method has to be chosen, audio materials seem to be the better choice. Regarding plants, they need to be selected with special care: it is beneficial if they stimulate not only the senses of touch and smell, but also the sense of taste. Plants can be arranged to form colourful sectors in the garden [Trojanowska 2014].

6. Conclusions

The main research questions raised in this article refer to the basic conditions required for inclusive outdoor recreation. The inventory of 15 sensory gardens showed that **outdoor experiences can be accessible to people with visual impairments** if there are **elements that facilitate spatial orientation**, which include intuitive path layout, various types of path surface and smells (which are season-dependent). Surface variety is the most commonly used infrastructural solution in gardens, which improves mobility and stay for blind and partially sighted visitors. Other frequently used elements of the infrastructure include tables, elevated flowerbeds, and ramps. Regarding **techniques for communicating information to blind and partially sighted visitors in sensory gardens,** the most popular touch-based solutions are sensory paths and interactive toys, tactile graphics, and tactile plans.

Outdoor experiences can be encouraged, rethought and redesigned for people with visual impairments in many ways. This goal can be achieved first and foremost by allowing visitors to hear, touch, and smell the surroundings and enabling them to move about freely and independently. The respondents' answers regarding **possibilities of moving independently (spatial orientation and safety) in a known environment; in a new, unknown environment and in a particular sensory garden** indicate that the appropriate arrangement of space in sensory gardens, even during the first visit, greatly facilitates independent movement. Solutions implemented in sensory gardens should be included as elements of the universal design of outdoor recreation areas. In the sensory gardens visited during the study, the blind and partially sighted respondents stressed the usefulness of intuitive path layouts, various types of path surfaces, assistance from other people, as well as textural markings on paths and audio messages. These factors also play a key role in providing the sense of safety, which is mainly the result of spatial order, but also the presence of helpful staff and reliable on-site equipment (security cameras, possibility to call an alarm by pressing a button). In general, the appeal of an outdoor recreation area is mainly determined by specific spots. The respondents mentioned that such spots should include areas with animals (that can be touched, smelled) and plants (that can be tasted), resting areas and areas

for active recreation, offering plenty of *auditory, tactile and olfactory stimuli* which the respondents found to be the most important sensual experiences.

The task of reducing and removing **socio-cultural barriers to outdoor participation** requires holistic actions that target all diagnosed barriers: cultural, environmental and informational ones. Blind and partially sighted respondents not only provided a detailed list of encountered barriers but also solutions they expected regarding the arrangement and design of parks, gardens, and city spaces. Both types of information are crucial in the process of universal design of publicly accessible space.

The results of the study indicate that, from the perspective of persons with visual disabilities, in the process of designing more universally accessible recreation areas, the optimal solution is to focus on elements that are useful to everyone. Such solutions are neither sophisticated nor expensive (i.e. intuitive path layouts, varied path surfaces, orientation landmarks, etc.). When these guidelines are respected, everyone will benefit from better convenience and a greater abundance of multisensory stimuli, which will increase the overall attractiveness of outdoor recreation. The study findings can be used as the basis for recommendations in the field of good practice of universal garden design, which can provide sensory experiences for everyone, including people with visual impairments. The current development of sensory gardens indicates a great interest in outdoor sites of this type, which are conducive to recreation, education, integration, and social inclusion. Solutions applied in sensory gardens should provide inspiration for creating universal gardens, accessible to everyone.

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Ogrody sensoryczne jako przestrzeń rekreacyjna dostosowana do potrzeb osób z niepełnosprawnością wzrokową

Abstrakt. Podjęte badania koncentrowały się na potrzebach osób z niepełnosprawnością wzrokową w zakresie dostosowania infrastruktury przestrzeni rekreacyjnej ogrodów sensorycznych. Celem badań była odpowiedź na następujące pytania: (1) W jaki sposób udostępniać przestrzeń rekreacyjną dla osób z niepełnosprawnością wzrokową? (2) W jaki sposób weryfikować zagospodarowanie przestrzeni rekreacyjnej pod kątem potrzeb osób z niepełnosprawnością wzrokową? (3) Jakie są bariery w uczestnictwie osób z niepełnosprawnością wzrokową w rekreacji na świeżym powietrzu w ogrodach sensorycznych? W poszukiwaniu odpowiedzi na powyższe pytania wykorzystano materiały wtórne oraz dane pierwotne. Do zastosowanych metod badań należały: inwentaryzacja wybranych ogrodów sensorycznych oraz wywiady z osobami niewidomymi i słabowidzącymi. Badania przeprowadzono w okresie czerwiec-sierpień 2018 r. Objęto nimi 15 ogrodów. Obiekty te znajdują się w różnych regionach Polski, w miastach, na obszarach wiejskich i obszarach cennych przyrodniczo. Wywiady (32) z osobami niewidomymi i słabowidzącymi przeprowadzono bezpośrednio w badanych ogrodach we współpracy z Polskim Związkiem Niewidomych. Wyniki przeprowadzonych analiz stanowią podstawę do sformułowania rekomendacji w zakresie uniwersalnego projektowania ogrodów, które mogą zapewnić wrażenia sensoryczne wszystkim, w tym osobom z dysfunkcjami wzroku. Obserwowany rozwój ogrodów sensorycznych jest związany z ich multisensorycznym oddziaływaniem i pełnieniem wielu funkcji (m.in. rekreacyjnej, edukacyjnej, integracyjnej). Zastosowane w ogrodach sensorycznych rozwiązania powinny być uwzględnione przy planowaniu uniwersalnych parków i ogrodów, dostępnych dla wszystkich.

Słowa kluczowe: ogrody sensoryczne, przestrzeń rekreacyjna, osoby z niepełnosprawnością wzrokową, osoby z niepełnosprawnością, projektowanie uniwersalne

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