

Perception-Based Valuation of Landscape in the Area around Lake Rusałka in Poznań, Poland, Using Wejchert's Impression Curve Method

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Abstract

The paper presents studies concerning perception-based analysis of landscape by means of the valuation method developed by Kazimierz Wejchert. This method consists in the scoring of landscape interiors of a given space. Evaluation concerned a recreation area located in the city centre around one of the best known water reservoirs in the city of Poznań. The experiment comprised investigations conducted by students of 6 specialisation groups, the field of study Horticulture, and lasted for 6 months. In that period students evaluated individual interiors of the study area. The aim of the analyses was to indicate differences in the perception of recreational landscape depending on different factors (specialisation within the field of study, gender, weather) as well as to potentially develop design guidelines for the management of recreational areas within the green wedges in the city of Poznań. Statistical analysis of the collected data facilitated formulation of more specific conclusions. Marked differences were found in the perception of landscape, depending on gender of respondents. The most attractive site was the area located immediately at the lake, while the ecotone zone, transition zone between ecosystems, proved to be least attractive. Slight differences were also found in the perception of landscape within the investigated specialisations within the field of study.

Keywords: Poland, Poznań region, Rusałka Lake, landscape evaluation, landscape perception

Introduction

Landscape is understood as a synthesis of natural, anthropogenic and visual factors (Żarska 2005). In the ecological, architectural and scenic aspects it is characterised by a complex structure comprising two basic components of landscape, i.e. composition and configuration (Fahrig 2005). Landscape is a sum of the phenomena, which reflect events of a given moment and place. In this process a flow of energy occurs (Bogdanowski, Łuczyńska-Bruzda, and Novák 1981).

An important aspect affecting the present-day appearance of landscape, apart from natural characteristics resulting from location and topographical features, is also its cultural value. The contemporary appearance of landscape is a result of transformations and events occurring in a given site. Moreover, it should be remembered that the future landscape will be a heritage of all the processes and changes occurring at present (Marcucci 2000, 67–81). For this reason the study of landscape is one of the basic tasks for landscape architecture. There are numerous valuation methods, based on graphic analyses, scoring, etc. One of these is the perception—based valuation of landscape (Morin 2009; Zube, Sell, and Taylor 1982).

Landscape affects all our senses and it is the main source of our perception of the environment. When speaking of the perception of landscape, should be mentioned: the degree of preservation, time and aesthetics. They all affect the perception of landscape, making it a complex source of an information. Perception of landscape depends on the degree to which we are able to notice, decipher and understand messages it contains. Taking into account the condition of economy, both agricultural and industrial, we may distinguish harmonious, disharmonious and degraded landscapes.

Individual types have characteristic features, that make it easy for people to describe particular types of landscape.

Time is another factor which plays a considerable role in the perception of landscape. Landscape changes over the years, thus it contains traces of the past in the form of historical objects. They are intertwined with the contemporary characteristics of landscape, influencing tradition and uniqueness of a given area. Landscape affects not only the human psyche, but also our physiology. Each element of landscape influences the observer in a specific manner. People perceive the surrounding environment with all their senses and these observations are enriched with their own feelings and experiences (Bartkowski 1983).

Multisensory perception of landscape refers to the perception of the surrounding environment with the sense of sight, hearing, smell and touch. Information from individual senses reaches the human awareness, affects it in various ways and plays different roles in the perception process. The most important role is played by the sense of sight which supplies the observer with a maximum amount of information. We perceive objects, motion, colour, light and distance. The range of vision may supply information within the radius of 90 m, whereas within the distance of 1600 m it is possible to maintain contact, while with range of hearing is markedly smaller. An important role in perception is also played by smell, whose spatial range depends on many factors, such as concentration, velocity and movement of air. A key element influencing the perception of landscape is connected with the capacity of the senses of sight, hearing and smell. Apart from perception by individual senses there also exists extrasensory perception connected with memories and experiences (Kowalczyk 1992).

Components of landscape such as topographical features, components of climate, vegetation, water, sounds, purity of atmospheric air and results of human activity are the factors affecting individual people, their emotional states, physiological and electromagnetic processes.

Topographical features of an area influence physical activity of individuals, have an impact on their body built and motion activity, while through the sense of sight they also influence their psyche. A hilly, undulating area is connected with exertion. Landscape will be perceived in dramatically different ways by observers standing on a hill top and by those standing in a hollow. Every individual will perceive the environment differently. For some people an open landscape will evoke the feeling of freedom and joy, while in others it will rather evoke fear or dejection.

Components of climate (temperature, insolation, pressure and air movements) affect humans through their skin, respiratory and nervous systems. Cloud cover, light and air cleanliness have a considerable effect on the acuity of vision. The nervous system is considerably influenced by wind. Its effects depend on its velocity, temperature and humidity. This may cause both positive and negative feelings. Frequently strong gusts of wind are accompanied by headaches and irritation, while on colder days they create the wind-chill effect. A slight breeze on hot days it refreshing, brings respite and lifts up the spirits. Moreover, wind is a carrier of aromas, which also influences the perception of landscape. Scent of flowers, herbs and trees brings positive impressions, while industrial odors—just the opposite.

Vegetation affects physiology and emotional states of people through their nervous and respiratory systems, the senses of sight and hearing. Vegetation has a tremendous effect on the composition of atmospheric air and on the local climatic conditions. Forest is a natural shield against pollutants, producing oxygen, absorbing carbon dioxide, affecting light conditions and reducing fluctuations in temperature. Forest air increases the concentration of negative ions and contains volatile substances with various therapeutic properties, thus positively influencing the airway, having a calming effect and lowering blood pressure. People appreciate most such space which is a combination of different plant complexes (e.g., forests or meadows). Aquatic vegetation also enhances the beauty of landscape, while playing additionally an important role as a biogeochemical barrier.

Human perception of the surrounding landscape is also influenced by sounds which may have positive or negative effects, depending on their intensity, pitch, harmony and sensitivity of human receptors. Natural sounds, such as the swoosh of sea waves, poplar or linden leaves have a positive effect on the perception of the surroundings. These are sounds with frequencies of 100 vibrations per second, providing the sensation of calm, harmony and relaxation (Kowalczyk 1992).

In recent years the visual evaluation of landscape has become an important aspect focused on in landscape management (de Val, Atauri, and de Lucio 2006). The primary criterion in the perception of landscape is connected with aesthetics, most frequently manifested in the form, shapes, colour and texture. Relationships between individual elements of landscape structure and perception are highly important factors in management and design of our surroundings. Therefore studies and analyses of these dependencies are necessary. To date numerous studies have been conducted, both on perception itself and on perception of landscape (Arriaza et al. 2004; Cloquell-Ballester et al. 2012; DeLucio et al. 1996; Palmer 2004; Yamashita 2002; Yu 1995). They have most frequently used analyses of photographs, questionnaires and diagrams (Ryan 1998) as well as GIS models (Brown and Brabyn 2012). In the perception—based valuation of landscape scoring scales are used as well as verbal descriptions of space given by each respondent (Palmer 1997).

1 Aim of the study

The aim of the conducted investigations was to assess variability in the perception of landscape depending on the weather, specialisation selected by students within the field of Horticulture and on the gender of respondents.

2 Methodology

Investigations were conducted in 2011 on a representative group of graduate students, the field of study Horticulture, Faculty of Horticulture and Landscape Architecture at the Poznań University of Life Sciences. Selected individuals studied within different specialisations: Ornamental Plants (RO), Vegetable Production (W), Pomology (S), Seed Production (NiSZ), Plant Protection (OR) and Landscape Architecture (KTZ). Students studying within the specialisation Landscape Architecture completed courses in green area design and green area management. Upon completion of these courses students have extensive knowledge in the principles of composition and management of green areas. The other participants in the study have only basic knowledge on green area management.

The experiment lasted for 6 months. It was conducted using the perception—based valuation of landscape, developed by Wejchert (1974). The method consists in the scoring of the surrounding space and according to Senetra and Cieřlak (2004) Wejchert's curve of impressions is one of the simplest methods from the technical point of view. According to this method space is divided into equal fragments so that they cover different characteristics of landscape. In the established points respondents evaluate landscape on a 10-point scale, where the following denotations are used:

- monotonous arrangement deprived of urbanistic or architectural value, limited view
- monotonous picture of repeated elements, enlivened with fragments of a more interesting architectural form and urbanistic detail, marked off in space
- simple arrangement of architectural value and with openings signaling a weak or partial linkage of a given interior with others
- arrangement with outlined individual features linked by space or architecture with the neighbouring interior
- urbanistic complex linked with more distant spaces, with a detail—a lack of clearly visible architectural dominants
- valuable urbanistic complex as regards architecture, not distinguished as an entity of considerable social importance
- urbanistic complex with interesting openings, diverse in form and character, and with an object dominant due to its form
- complex as mentioned above with a significant dominant
- complex of high urbanistic and architectural value, dominant as an element of spatial structure of the city
- complex as mentioned above, enriched with several dominants of basic importance to the city, its outline and townscape

The impression curve is presented as a graph (fig. 1) in which the horizontal axis is the time and linear scale marking successive view points over the route travelled by the observer. The vertical axis presents the tension of impressions. The obtained graph should be interpreted as an illustration of average impression. This provides a possibility to compare individual fragments of space as regards their form, architecture, greenery and vistas.

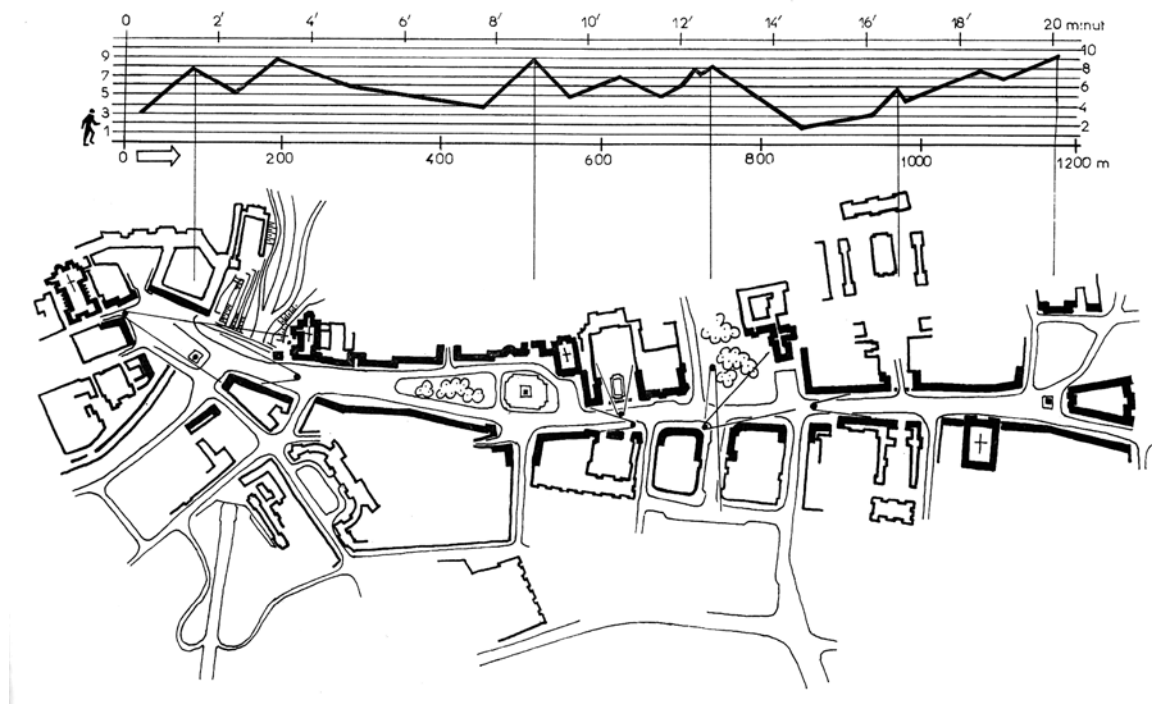


Fig. 1. An example graph of the impression curve

Source: Wejchert (1974)

3 Study area

Analyses were conducted in Poznań (the Wielkopolskie Voivodship). The selected area of the city is incorporated into the recreation areas of the western (Lasek Goleściński) green wedge of the city. Poznań has a specific system of green areas, exemplifying the ring-wedge system of urban greenery (Urbański, Szpakowska, and Raszeja 2008). This system according to Bożętka (2008) is an arbitrary conceptual unit comprising green areas in the city, arranged into a certain organisational system which usually corresponds to urban planning.

Green wedges in the city of Poznań were formed at three main watercourses, i.e. the Warta, Bogdanka and Cybina Rivers. They cover the area of reservoirs and watercourses, parks, promenades and sports facilities. All these areas are freely available to residents and are used for both active and passive recreation.

Lake Rusałka was selected for the analyses (fig. 2). It is an artificial water reservoir, through which the Bogdanka flows. Footpaths and bicycle routes are located around the lake.

For the purpose of the analyses on the water body a total of 18 representative points were identified (fig. 3), in which basic features of the landscape in this area were identified. These sites were arranged so that the observers (students) stopped at 5-minute intervals. The points included different types of ecosystems:

- lake
- meadow
- forest
- ecotone



Fig. 2. A view of Lake Rusalka

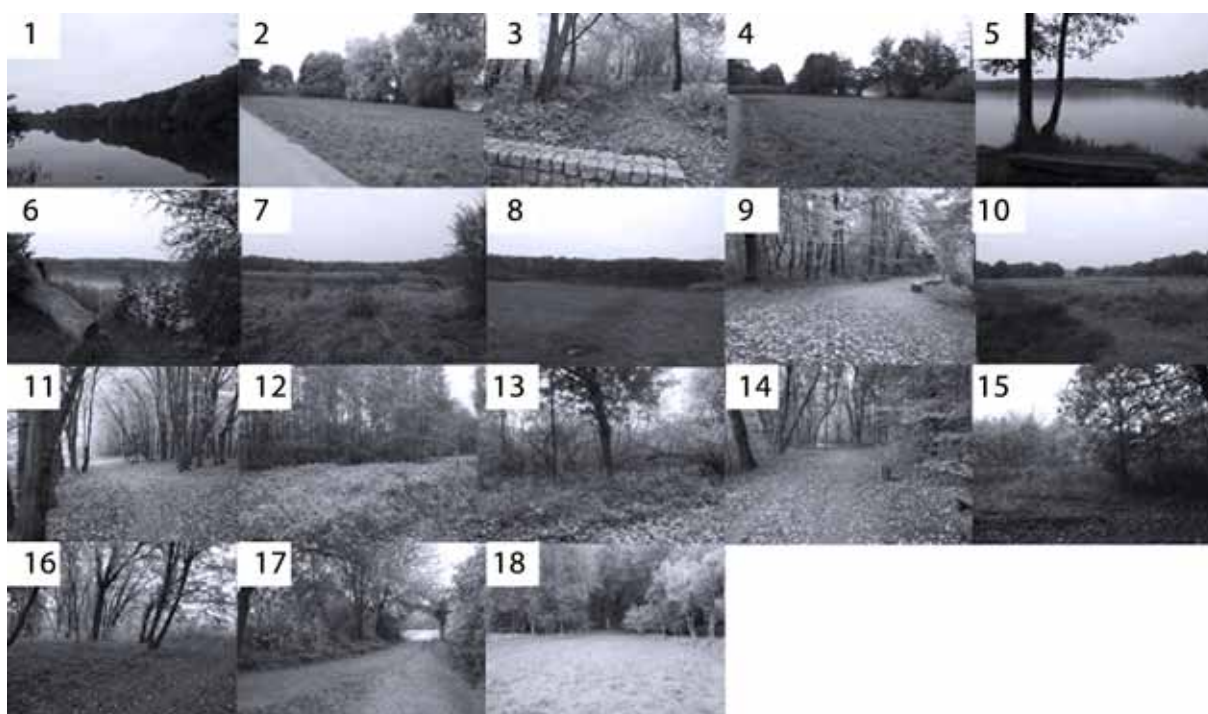


Fig. 3. Points in which landscape valuation was performed using the impression curve according to Wejchert (1974)

A monument is visible in the last established point, constituting a strong cultural feature in the surrounding landscape.

Students ascribed scores from 1 to 10 on the previously prepared charts. They covered subjective feelings of each respondent. During the analyses provided by representatives of different groups and genders there was a change in the weather, which was included in the elaboration of the results. Prior to the analysis a short multimedia presentation was given to each group providing:

- definition of perception of landscape
- discussion of features influencing the perception of individual landscape interiors
- valuation of landscape using Wejchert's impression curve

4 Results

The results given below (tab. 1 and fig. 4) indicate that the observation points nos. 1, 5, and 9 received the highest scores. The two former were located immediately at the lake, while point no. 9 is a forest road. The immediate vicinity of the water body and a linear element such as the road

Tab. 1. Minimum, maximum and mean values as well as standard deviation within 6 specializations

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
KTZ	min	1	2	3	3	4	4	3	4	3	3	3	2	2	2	3	2	2	
	max	8	9	6	8	9	8	8	9	8	9	9	7	7	7	7	7	7	
	mean	5,06	4,72	3,39	4,94	6,17	6,06	5,89	4,78	6,72	4,39	5,22	6,22	4,50	4,67	4,72	5,06	3,94	4,22
	s.d.	1,98	2,05	1,33	1,35	1,58	1,59	1,18	1,40	1,60	1,58	1,86	1,83	1,47	1,37	1,23	1,06	1,43	1,40
W	min	4	2	1	3	4	5	2	3	5	1	1	1	1	1	1	1	1	2
	max	9	9	6	9	9	9	8	7	9	8	9	9	8	9	8	7	6	5
	mean	6,43	5,50	3,29	6,36	6,71	6,79	5,64	5,43	8,00	5,07	5,07	4,93	4,07	5,29	4,64	3,86	3,57	3,86
	s.d.	1,50	1,95	1,64	2,13	1,64	1,37	1,82	1,16	1,41	2,06	2,09	2,76	2,06	2,89	2,59	1,99	1,99	0,86
S	min	4	4	2	2	4	4	2	5	2	3	1	1	2	1	2	2	1	3
	max	8	8	6	8	9	9	7	9	9	9	9	5	7	8	6	5	7	
	mean	6,00	6,57	3,86	5,64	6,07	5,64	4,29	6,36	5,93	6,29	4,43	4,21	3,14	4,50	5,14	3,79	3,21	5,43
	s.d.	1,41	1,16	1,23	1,82	1,44	1,74	2,05	1,34	2,53	2,20	2,74	2,58	1,03	1,79	1,61	1,31	1,31	1,55
RO	min	6	2	1	5	4	2	2	3	5	4	4	1	1	1	1	2	1	2
	max	9	9	8	9	9	9	6	9	9	9	9	8	4	4	7	9	7	8
	mean	7,40	6,13	3,07	6,87	6,80	5,47	4,40	6,33	7,93	5,93	6,47	5,40	2,00	2,07	3,20	4,80	4,00	3,73
	s.d.	0,83	1,96	2,05	1,06	1,74	2,00	1,24	1,76	1,44	1,79	1,60	2,16	1,00	0,88	1,37	1,86	1,85	1,62
OR	min	5	4	1	4	2	2	4	1	6	3	1	5	1	1	2	3	2	1
	max	8	7	6	8	8	9	9	8	9	9	9	9	9	8	8	8	6	6
	mean	6,67	5,33	3,44	6,44	5,44	5,67	6,89	5,22	7,56	6,56	6,33	7,67	4,44	4,44	5,33	5,00	4,67	3,44
	s.d.	1,22	1,32	1,94	1,42	2,24	2,35	2,03	2,28	1,13	2,46	2,60	1,50	2,65	2,35	1,80	1,50	1,50	1,74
NISZ	min	5	1	1	2	3	4	3	2	3	2	3	1	1	1	1	2	2	2
	max	9	8	4	7	5	7	6	8	9	9	7	7	6	6	5	5	5	2
	mean	7,67	5,00	2,33	4,83	4,00	5,33	4,33	4,67	6,67	4,83	4,83	4,83	2,83	3,00	3,17	3,67	2,67	2,00
	s.d.	1,75	2,53	1,03	1,94	0,63	1,03	1,37	2,07	2,25	2,32	1,47	2,23	1,94	1,67	1,47	1,37	1,21	0,00

Note: [In the journal (in both Polish and English texts) European practice of number notation is followed—for example, 36 333,33 (European style) = 36 333.33 (Canadian style) = 36,333.33 (US and British style). Furthermore in the International System of Units (SI units), fixed spaces rather than commas are used to mark off groups of three digits, both to the left and to the right of the decimal point.—Ed.]

had a calming effect on human senses, which was manifested in the mean scores in most groups participating in the experiment.

The lowest scores were given to sites denoted as nos. 3, 13, 17, and 18. The location at a dry discharge point, littered and much shaded, received the worst scores. Sites nos. 13, 17, and 18 received low scores. The first of them was densely overgrown with shrubs, while the others were strongly shaded. All the points with low scores had two features in common: they were unmanaged and their surroundings were heavily littered (bottles, plastic bags, paper).

When analysing the graph below we may observe a greater scatter (amplitude) of the mean values for all the specialisations in the valuation points nos. 12–18. This was most probably due to fatigue caused by a long trek, which might have had a tangible effect on the scores. The highest consistency in the student's scores was found for points nos. 3, 8, and 9 (fig. 4).

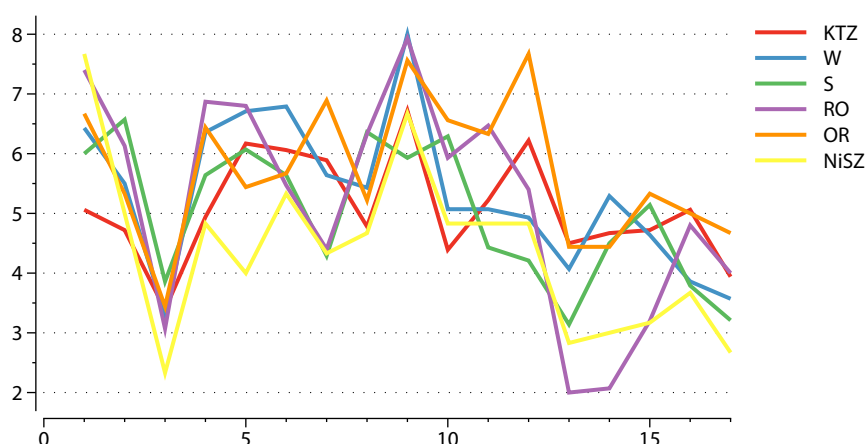


Fig. 4. Averaged trends in the evaluation of observation sites for the 6 specialisations

Statistical analyses were conducted using the Canoco 4.5 for Windows package, while the calculations were presented in the graphic form in the CanoDraw for Windows programme. In order to verify which explanatory variables (specialisation, gender of the observer or weather conditions) determine dependent variables (in this case the observation sites) the discriminatory analysis was applied. A synthesis of all variables made it possible to create a CVA model. The model was constructed using the canonical variate analysis (CVA), a canonical variant of Fisher's linear discriminatory analysis (LDA).

In order to construct the model characterised by the best degree of prediction, the following stepwise analysis was applied. First these variables were included in the model, which described it most accurately. As a result of the analysis of the discriminatory function only variables significant for the model were obtained. The progressive stepwise analysis was performed on the basis of the values of F and p . The progressive stepwise analysis was preceded by the Monte Carlo permutation test (separately for each variable, and next for the entire model) in order to determine the boundary level of significance (tab. 2).

Tab. 2. Correction coefficients for explanatory variables

Variable	F	p	% EXPL
RO	6,267	0,001	31,25
KTZ	5,949	0,001	31,25
S	4,392	0,001	21,87
W	3,192	0,001	15,62
OR	2,122	0,014	12,50
NiSZ	1,739	0,054	9,37

The model below presents dependencies between the observed sites and explanatory variables (specialisation, gender and weather conditions). Sites nos. 1, 4, and 11 received the highest scores from the representatives of specialisations: Plant Protection (OR), Seed Production (NiSZ) as well as Ornamental Plants (RO), while sites nos. 13 and 14 – from the students of Vegetable Production (W) and Landscape Architecture (KTZ). During rain students gave higher scores to observation points nos. 13 and 14 (small interiors), while in the sunshine it was sites nos. 2, 8, and 10 (open areas). It is worth mentioning that men (in contrast to women) gave higher scores to sites nos. 2, 8, and 10 (i.e., open, exposed places, of considerable area, highly casual). For women, in turn, these were points nos. 9, 12, 16, and 17 (i.e. mainly linear elements — e.g., roads (fig. 5)).

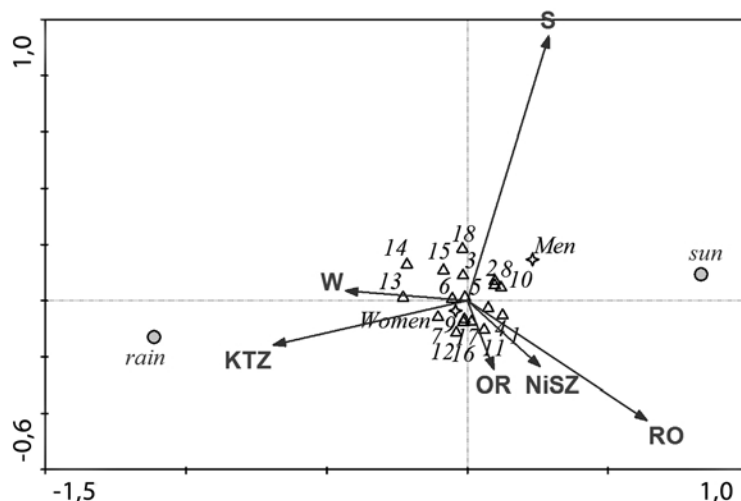


Fig. 5. CVA model ($n = 86$)—dependencies between observed sites and specialisations, weather conditions and gender of respondents ($p < 0,05$)

For a more comprehensive presentation of the results a comparison was made for the mean scores given by students of the Faculty of Horticulture and Landscape Architecture to ecosystems found in the surroundings of Lake Rusałka (fig. 6). The highest mean score was obtained by the lake ecosystem, while the lowest — the ecotone, i.e. transition zone between the two ecosystems. The low score might have resulted from the area being visually unattractive, as these areas were frequently shaded and covered by dense low shrubs.

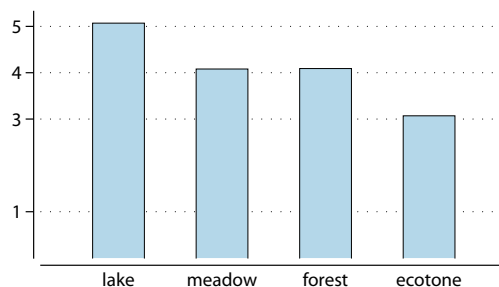


Fig. 6. Mean scores for ecosystems in the vicinity of Lake Rusałka given by students of the Faculty of Horticulture and Landscape Architecture

Conclusions

The perception—based valuation of landscape showed that all the specialisations perceived the landscape around Lake Rusałka in a similar manner; however, the tested area received the highest scores from students of Vegetable Production (W) and the lowest—from students of Seed Production (NiSZ). The highest scores were given to sites located immediately at the lake and connected with forest, while the lowest scores were given to undeveloped, shaded and littered areas.

On sunny days higher scores were given to exposed places, while on cloudy and rainy days it was small spaces which formed interiors. Marked differences were found in the evaluation of landscape by women and men. Women appreciated more the linear elements (roads), while men preferred vast open, free areas. Students participating in the experiment gave the highest scores to the lake ecosystem, while the lowest—to the ecotone (i.e., transition zone between the two ecosystems). Landscape evaluation was definitely influenced by fatigue, which was evidently manifested in the discrepancies between the mean values (in scores given by students) after 1 hour of the experiment. Based on the conducted analyses it may be stated that one of the most significant features to be considered when designing a public space, should include the length of promenades as well as variety and variability of landscape.

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