Michał Krupa*
orcid.org/0000-0002-2199-0598

Łukasz Bednarz***
orcid.org/0000-0002-1245-6027

Małgorzata Lisińska-Kuśnierz**
orcid.org/ 0000-0003-0087-6427

Alirza Mamedov****
orcid.org/ 0000-0003-4703-2694

Eye-Tracking Study of the Perception of Contemporary Works of Architecture Built in a Historic Cultural Landscape on the Example of German Cities

Badanie eyetrackingowe postrzegania współczesnych obiektów architektonicznych w historycznych krajobrazie kulturowym na przykładzie miast niemieckich

Keywords: eye tracking; visual perception; historic cultural landscape; German cities; case study; application in architecture and management

Słowa kluczowe: metoda eyetracking, percepcja wzrokowa, historyczny krajobraz kulturowy, niemieckie miasta, studium przypadku, aplikacja w architekturze i zarządzaniu

Introduction

The protection of historic cities involves actions necessary to secure, conserve and restore them and to ensure their harmonious development and adaptation to the needs of contemporary life.[1] UNESCO and ICOMOS documents concerning the protection of such cities define the principles, objectives, methods and means of action appropriate to conserving the character of historic cities and that are beneficial to the harmony of life of individuals and communities. These recommendations indicate, among other things, the proper actions to be taken when introducing contemporary elements into existing historical development. All supplementations of this development should be introduced while maintaining the spatial layout and scale of existing development as mandated by the character and value of the complex. The introduction of contemporary elements can contribute to enriching a given complex under the condition that they will not adversely affect the harmonious entirety of its development. Historical zone management guidelines indicate the importance of, among other things, proper communication between the designers of contemporary buildings with society and the enhancement of society's knowledge about the past of historic cities.[2] Exploring the assessment and visual perception of the designs of contemporary architecture and its later materialization in

* *D.Sc. Ph.D. Eng. Arch., Faculty of Architecture, Cracow University of Technology*
** *Prof. D.Sc., College of Management and Quality Science, Cracow University of Economics*
*** *Ph.D. Eng., Wroclaw University of Science and Technology*
**** *Ph.D. Eng., Kyiv National University of Construction and Architecture*

* dr hab. inż. arch., prof. PK, Wydział Architektury Politechniki Krakowskiej
** prof. dr hab., Kolegium Nauk o Zarządzaniu i Jakości Uniwersytetu Ekonomicznego w Krakowie
*** dr inż., Wydział Budownictwa Lądowego i Wodnego Politechniki Wrocławskiej
**** dr inż., Kijowski Narodowy Uniwersytet Budownictwa i Architektury

Cytowanie / Citation: Krupa M., Lisińska-Kuśnierz M., Bednarz Ł., Mamedov A. Eye-Tracking Study of the Perception of Contemporary Works of Architecture Built in a Historic Cultural Landscape on the Example of German Cities. Wiadomości Konserwatorskie – Journal of Heritage Conservation 2021, 66:172–181

Otrzymano / Received: 18.02.2021 • Zaakceptowano / Accepted: 1.04.2021 **doi: 10.48234/WK66EYE**

Praca dopuszczona do druku po recenzjach *Article accepted for publishing after reviews*

a historic landscape is critical due to the necessity to ensure the harmony of individuals and communities in compliance with global policy guidelines concerning the conservation of historic cities and a new, holistic paradigm of their development.

Many contemporary architectural projects that supplement development in a historic landscape are considered to be successful and to harmoniously blend into the extant cultural context by experts, i.e. architects.[3] Examples of this include contemporary works of architecture in German cities like Dresden and Bremen.[4] However, there are no scientific reports on the perception and assessment of these buildings by individuals and communities.

The authors carried out this empirical study to determine the scope and manner of the perception of contemporary works of architecture located in the German historic cities in question, as well as to learn how persons who are not architectural professionals rate such buildings and the degree to which they accept them.

An analysis of the current state of research into the possibilities of applying eye-tracking in studies of architecture and the results of the authors own experiments allowed the performance of eye-tracking studies to try to solve the research problem under study.

The application potential of eye tracking in assessing visual perception of the environment of the viewer has been indicated by increasingly frequent experimental studies whose scope likewise keeps increasing. These studies discussed visual perception of works of architecture, landscape architecture and public spaces in cities, including historical cities.[5]

Depending on individual research goals, the literature demonstrated the utility of both the application of eye tracking using stationary and mobile devices by itself and its application in combination with research tools from other methods. Studies concerning visual perception should be performed in a comprehensive manner, utilizing tools and research methods from the social sciences (sociology, cognitive psychology, management) and medicine (electroencephalography testing—EEG).[6]

Such studies allow researchers to explore not only the visual perception of works of architecture and their surroundings from the perspective of objective numerical data, but also to note the emotions of test subjects and assess their level of awareness in terms of knowledge and attitudes.

The primary reason behind using the oculographic method is that it allows the objective study of the perceptive activity of subjects. Visual perception and eye-tracking are fundamentally linked. Visual perception, as a multi-stage cognitive process, consists in reflecting objects, phenomena and processes that take place due to the impact of specific stimuli on the eye. The process of perception begins with noticing the stimulus that conditions an understanding of what has been perceived and the implementation of information received in one's system of knowledge and values and, in effect, remembering it. Perception depends on the type of elements in an exposition and the individual characteristics of the viewer, primarily the degree of their knowledge about the subject of the exposition.[7]

A typical eye tracking measurement is based on recording two types of information:

— Fixations, i.e. points where the subjects affix their gaze. Visual information is collected during a fixation. The area where a person affixes their gaze allows us to determine what that person has noticed.
— Saccades, i.e. eye movements that relocate one's gaze from one point to another (between fixation points). During a saccade movement (20–40 milliseconds), the brain does not receive any visual information.

The most often used forms of the graphical presentation of data obtained during eye-tracking studies are: heat maps, gaze plots and area of interest analyses.[8]

Materials and methods

The research material was comprised of visualizations of three contemporary works of architecture built in the historic landscape of two cities: Dresden and Bremen. The selection of examples of contemporary buildings located in the vicinity of historic monuments accounted for projects designed by outstanding, world-famous architects, and which are acknowledged in the architectural community to blend well with the historic landscape.

The first view investigated in this study displays a fragment of the cultural landscape of the old town of Dresden, as seen from the south, from the side of a small square located at the intersection of Taschenberg and Schloßstraße. The view is comprised of fragments of two buildings. To the left is the residence of the dukes of Saxony, while to the right is a contemporary hotel building.

The residence of the dukes of Saxony is one of the city's oldest monuments. The complex was built around 1200. It was built in the Romanesque style, which was prevalent at the time. Around 1400, the castle was remodeled and extended by margrave Wilhelm dem Einäugigen.[9] Another remodeling project was carried out between 1468 and 1480, when the residence took on the form of a four-winged enclosed complex.[10] The remodeling and extension projects that followed it were carried out in the spirit of Renaissance and Baroque art.[11] The modernization project dated to the middle of the sixteenth century was of particular significance, as it was then that the castle courtyard was doubled in size and additional decoration was added to the facade in the in the form of sgraffito, made by Italian artists. It was then that the residence became the most accomplished example of the Saxon Renaissance. Additional construction work was performed on the complex in the seventeenth century, under the influence of the Baroque style. Another renovation of

Fig. 1. View of the buildings under study in Dresden (photograph 1); 2017, photo by: M. Krupa.

the castle was performed in the years 1889–1901. It was a general renovation and the residence was given a Renaissance Revival expression. The building was damaged during Allied bombing raids in 1945. After the war, a reconstruction effort was initiated and lasted until 2004, when the castle was made available to visitors. The reconstruction was modeled on the original building, which is why its form and detail have a historical expression. Despite the residence being open to visitors, restoration and adaptation work is still being carried out. At present, the complex is used as a museum and an arts gallery.

One of the wings of the residence can be seen on the left side of the view in question. It has the expression of historicist architecture. The corner tower is made of dark stone, while the facades, both from the side of Taschenberg and Schloßstraße, are brighter (light beige in color), with darker stone cladding on the ground floor.

On the right side of the view we can see a fragment of a hotel building located at the intersection of Schloßstraße and Sporergasse. The building is an example of contemporary architecture that fits well with its historical surroundings. Its size references the historical buildings that previously stood at the site. The design of the building's facade was selected in 2012 via an architectural competition which was won by Schubert + Horst Architekten. The building is both elegant and modest. According to its architects, it was possible to produce an impression of supplementing the extant cultural landscape without competing with the historical residence of the dukes of Saxony. The design employed high-quality construction materials. The ground floor is bright in terms of color. Golden finishing elements on the building's windows are a decorative element. The simple oriels located on its roof are likewise interesting (Fig.1).[12]

The second view that was studied depicts a fragment of the cultural landscape of the old town of Bremen, as seen from the south, from the side of Am Brill Street. It is comprised of two buildings, one of which is historic and one is contemporary. Both are service buildings of Sparkasse Bremen, a savings bank.

The historic building seen on the photograph is a fragment of a larger structure located along Bürgermeister-Smidt-Straße. Sparkasse Bremen was ultimately founded in 1825 on the initiative of Simon Hermann Nonnen, who was Bremen's mayor at the time. Since then, the institution has seen dynamic development and in 1906 opened another branch at Am Brill Street. The building was designed by Berlin-based architect Wilhelm Martens, in the style of then-fashionable Historicism. Elements from the periods of the Baroque, Renaissance and Secession can be found in the design.[13] The building stands out through the elegant arrangement of its facade, which is well-preserved. It was finished using grey stone cladding. The building is topped by tall, patina-covered roofs.

Fig. 2. View of the buildings under study in Bremen (photograph 2); 2017, photo by: M. Krupa.

The fragment of the historic building visible in the view under analysis includes, apart from the facade along Am Brill Street, also a corner section which has a polygonal plan, and which is a compositionally dominant element of the building. The frontal facade features an accentuated entrance via a rectangular, minimalist portal, which displays the name of the institution.

There is a small square in front of the building, which was renovated in 2007. During the same year, a bronze sculpture entitled Affentor by sculptor Jörg Immendorff was placed on the square. The sculpture, which is 6.25 x 3.8 m x 2 m, has the shape of a gate formed by four figures resembling monkeys. The artist uses the monkey motif in his sculptures and paintings as a metaphor for self-mockery, clowns and the role of the artist in society.[14]

The historic Sparkasse building is abutted from the west by a newer building, which belongs to the same institution. It was built in 2001 by architects Harm Haslob and Peter Hartlich at the site of a part of the main building.[15]

Despite a very modern character, architects think the contemporary building has been harmoniously blended into the context of the place. Its facades are comprised of curtain walls and are completely glazed. Of note is the fact that, despite the contemporary building's style being completely different, the divisions on its facade reference the composition of the historic building. Deciduous trees have been planted in front of the building and add a "soft" character to this space. It should also be noted that both buildings are of the same height and together form a cohesive fragment of Am Brill Street's frontage (fig.2).

The study was performed on a purposive sample. The primary participant selection criterion was education without a connection to architecture and no eye disorders. The sample comprised 100 volunteers of varying sex, aged 20–30, from several European countries, including Poland, who were mostly students of Krakow's universities. The number of participants was sufficient from the point of view of methodological assumptions[16] as well as positively verified during earlier studies performed by the authors.[17] Prior to the study, every participant was informed about the testing procedure, without disclosing the objective of the study, the manner of analyzing the gaze plot of the subject or the subject of questions. Withholding this information was deliberate so as not to suggest areas where the subjects could focus their attention. The study was performed using a stationary Tobii x2-30 Compact eye tracker with proprietary software.[18] Prior to displaying the photographs on-screen to each subject, the eyetracker was calibrated to adapt it to every subject's eyeballs. Every participant was shown 20 slides. After a series of introductory slides with information about the study, each of the photographs was displayed for 10 seconds. Afterwards, as a part of a survey, the subjects were shown slides presenting

Fig. 3. Identified areas of interest and the non-classified area for photograph 1, legend: 1AOI1—contemporary building, yellow; 1AOI2—historical building, green; Not on 1AOI, grey.

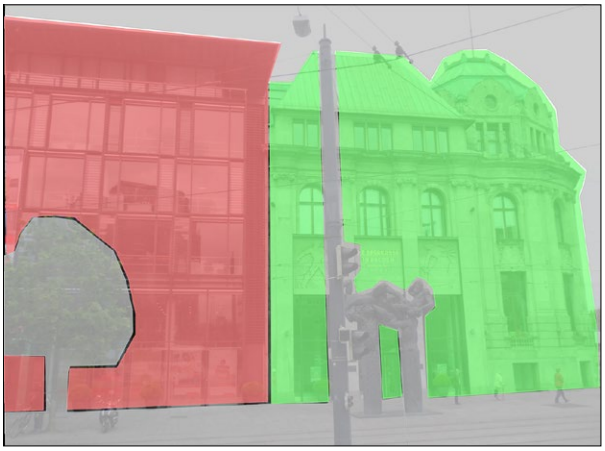

Fig. 4. Identified areas of interest and the non-classified area for photograph 2, legend: 2AOI1—contemporary building, pink; 2AOI1—historical building, green; Not on 2AOI, grey.

a short text concerning the contemporary building and its historic surroundings, a request to identify the building that inspired the greatest interest on the photograph, followed by a question about whether the contemporary building was acceptable in the context of being located near to a historic building and whether both buildings matched each other. The final request given to the subjects asked them to identify the building they liked the most on the slide. It was essential to present the subjects with information about contemporary buildings and their historic landscape prior to the assessment of architecture, so that the message would be underscored as a result of perception due to the supplied substantive knowledge.[19]

The eyeball movements of all subjects were recorded on a computer and processed using specialist software so that various types of images of said movements could be generated.[20] Due to the goal and subject of the study, the following sequence and scope of analysis was assumed for each photograph:

— definition of areas of interest and unclassified areas,
— generation of descriptive statistics measures, i.e. quantitative data for the areas defined,
— presentation of selected cumulative quantitative data in graphical form as heat maps,
— generation of data pertaining to answering the questions asked in the study.

For photograph 1, which displayed buildings in Dresden, 2 areas of interest were defined (1AOI1—formed by the contemporary building; 1AOI2—formed by the residence of the dukes of Saxony). Furthermore, an unclassified area was also included (Not on 1AOI) due to the possibility of it featuring elements that could distract from areas important to the study, i.e. distractors (Fig. 3).

For photograph 2, which displayed the buildings in Bremen, 2 areas of interest were defined (2AOI1—formed by the contemporary extension of a historic building; 2AOI2—the historic Sparkasse building). The unclassified area (Not on 2AOI) was formed by the street along the buildings with the sculpture in front of the entrance to the historic building, a street lamp and the greenery in front of the contemporary extension, which can distract viewers by attracting their attention (Fig. 4).[21]

The data, i.e. the parameters generated for each area, were:

— Time to first fixation (TTFF), which allows one to determine the time necessary to find a given area;
— Fixation count for all subjects (FC); it was assumed that a large number of fixations translates into greater interest in an area;
— Total fixation duration (TFD), i.e. the total fixation duration in an area for all viewers;
— Average fixation duration (FD);
— Visitor count (VRC), i.e. the number of persons who made at least 1 fixation relative to the total number of subjects—it was assumed that the greater the percentage of such persons, the greater the attractiveness of a given area to viewers;
— Average fixation per visitor (FC/VRC);
— Visit count (VC); it was assumed that the greater the visit count in a given area, the more interesting it appears to the viewer (it can present interesting or difficult content, hence it is revisited so as to facilitate understanding information);
— Average visit count per visitor (VC/VRC);
— Revisitor count (RC), i.e. the number of subjects who made at least 2 fixations relative to the number of study participants—it was assumed that the greater the percentage of revisitors, the greater the interest in an area;
— Revisitors in proportion to visitors (RC/VRC)—it was assumed that the greater the percentage of revisitors in proportion to visitors, the greater the exploration of the area by viewers who became interested in it.[22]

Heat maps were generated as fixation-count maps presenting the perception of the buildings by viewers as per fixation count distribution.

Item no.	Parameter	Dresden	Bremen				
		1AOI1	1AOI2	Not on 1AOI	2AOI1	2AOI2	Not on 2AOI
1	Average time to first fexation TTFF (s)	1,772	0,251	3,078	1,342	0,526	1,349
2	Fixation count FC	517	1861	134	625	1082	563
3	Total fixation duration TFD (s)	185,04	698,43	48,26	223,28	501,33	224,04
4	Average fixation duration FD (s)	0,358	0,376	0,360	0,357	0,463	0,398
5	Visitor count VRC	94/100	100/100	65/100	99/100	100/100	99/100
6	Average fixation per visitor FC/VRC	5,50	18,61	2,06	6,31	10,82	5,67
7	Visit count VC	254	391	122	334	439	361
8	Average visit per visitor VC/VRC	2,70	3,91	1,87	3,37	4,39	3,64
9	Revisitor count RC	84/100	99/100	36/100	95/100	100/100	92/100
10	Revisitors in proportion to visitors RC/VRC	84/94	99/100	36/65	95/99	100/100	92/99

Table 1. Parameters that characterize the process of the perception of the outlined areas on photographs 1 and 2.

Results

The parameters that characterize the process of the perception of the outlined areas of interest and unclassified areas accounted for in the assessment of contemporary and historic architecture were presented in table 1.

Analysis of the generated numerical data concerning contemporary buildings in the historic landscape of Dresden and Bremen showed that these projects did not attract as much attention as historic buildings. The contemporary building in Dresden, despite having a brightly colored facade with symmetrically placed windows with golden finishes and a steep roof with red tiles and simple oriels, was not as interesting to viewers as the historic building. This was demonstrated by numerical data such as: TTFF (a value seven times greater) and FC (a value around four times lower) for the contemporary building. Despite the darker color and stone texture of the facade, the historic building with a corner tower and a large number of historic elements was not only noticed by all viewers to a greater degree, but was also penetrated numerous times by almost all subjects (VRC, RC and RC/VRC). Similarly, the modern building abutting the main historic Sparkasse building in Bremen was noticed later and proved to be less interesting to viewers than the historic building. However, the differences in parameter values were not as significant as in the first case (TTFF—around three times greater, FC—two times lower). The contemporary extension has a simple form with facade divisions that reference historic divisions and is fully glazed, thus causing its surface to form light reflexes which can reasonably be considered to attract viewer attention. The historic building has a more elaborate architectural form with Baroque and Secession elements, a facade with numerous windows of varied size and shape and a tall, patina-covered roof. In Bremen, the unclassified area (Not on 2AOI) attracted a similar amount of interest to the contemporary building (2AOI1), as proven by a VRC of 99/100. It can be assumed that the Affentor sculpture in front of the entrance to the historic building and the technical infrastructure and greenery, by attracting the attention of viewers, formed distractors from the point of view of the objective of this study. When analyzing the parameters describing the process of the perception of both contemporary buildings in their respective historic landscapes and, most importantly, the value of the attractiveness estimator (RC/VRC for 2AOI1 = 95/99 and for 1AOI1 = 84/94), it can be concluded that the contemporary building in Bremen attracted more interest than its counterpart in Dresden.

To identify the places and elements that attracted the attention of subjects on each photograph, count heat

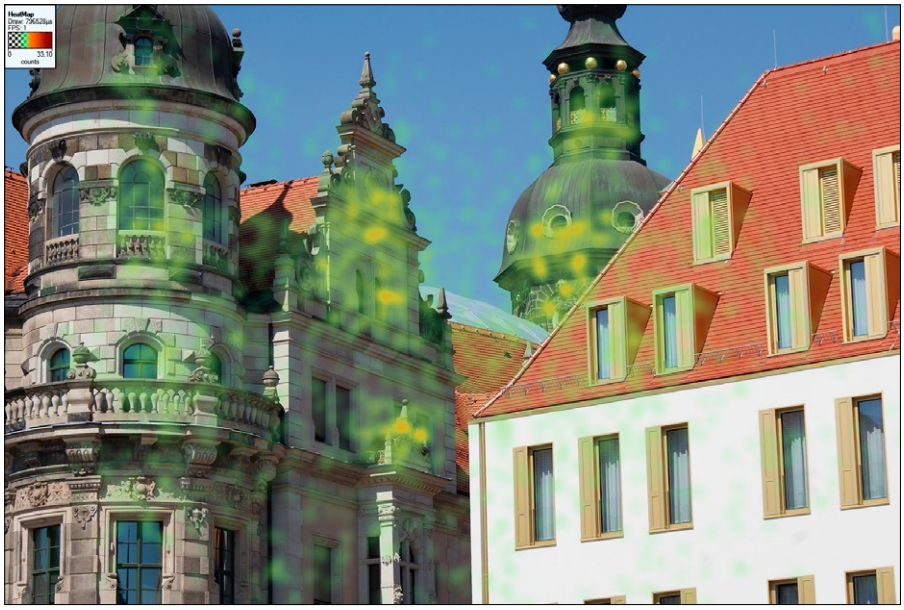

Fig. 5. Heat map count for all subjects for photograph 1.

maps were generated for all subjects, as presented in figures 5 and 6. Assuming an identical color scale, a diverse saturation of warm and cool colors was obtained on each photograph, indicating a different distribution of fixations performed in analogous areas of interest.

The heat map for photographs 1 do not show any "hotspots," i.e. areas with a significantly greater focus of interest and showing a substantial increase in fixation counts. Photograph 1 displayed numerous yet small oval yellow areas with a green outline (around a dozen instances), primarily in 1AOI2. Furthermore, a considerable amount of green areas with irregular shapes was observed across the entire photograph. The heap map for the buildings in Bremen had two hotspots in 2AOI1. The first was a small brown spot that turned red and orange, with a yellow outline. It was located in the area of the facade with the inscription reading DIE SPARKASSE IN BREMEN. Furthermore, below this hotspot, in the area Not on 2AOI, there was an irregular orange area that denoted interest in the Affentor sculpture in front of the entrance to the historic building. In addition, there were around 10 yellow and many more green areas, which did not allow the identification of areas of increased viewer interest.

These studies enabled the authors to draw conclusions about the perception of contemporary buildings in their historic landscape based solely on an analysis of the eye movements of test subjects. Expanded studies were intended to supplement this analysis to include the cognition and rating of these buildings by subjects. The collected ratings for the contemporary buildings built in the vicinity of historic buildings in the cities under analysis have been presented in table 2.

Contemporary buildings in Dresden and Bremen inspired considerably less interest among the respondents than historic buildings. The building that was an extension of the Sparkasse in Bremen, built using curtain wall technology and fully glazed, attracted the interest of more people (almost a quarter of the subjects) when compared to the hotel building in Dresden, which had a bright, simple and non-ornamental facade and was located opposite the residence of the dukes of Saxony. At the same time, their architecture was accepted in the context of their proximity to historic buildings and this placement was rated favorably. Despite the clearly accepted architecture of contemporary buildings (such indications were reported by over three-quarters of the respondents), they were given considerably lower ratings in comparison to historic buildings. It can be said that contemporary buildings built in the center of Dresden and Bremen, while appreciated by professionals in the context of their construction in a historic landscape, were accepted by the respondents, but did not inspire explicitly positive emotions.

Studies conducted in urban space where the structures under analysis are located, with the use of mobile equipment, can complement the presented study. Such studies allow for analyzing all the works of architecture and infrastructural elements seen from a given observation point or during movement while sightseeing. Such studies can supplement our analysis by showing the degree to which the attention of viewers who observe architecture is diverted by elements or figures that attract interest.

Conclusions

The study found that the cases of contemporary architecture under study—that supplement the development of the historic landscape of cities like Dresden and Bremen and are considered to be successful and to harmoniously blend into the extant cultural context by the architectural community—were not perceived

Fig. 6. Heat map count for all subjects for photograph 2.

Item no.	Building rating scope		Building ratings [% of indications]	
			Dresden	Bremen
1	Identification of the building that is more interesting	Contemporary	9	24
		Historic	91	76
2	Acceptance of the architecture of the contemporary building in the context of its proximity to the historic building	Yes	79	75
		No	21	25
3	Are the buildings matched well?	Yes	63	71
		No	37	29
4	Identification of the building which is liked more	Contemporary	8	22
		Historic	92	78

Table 2. Ratings of contemporary buildings built in the vicinity of historical buildings as given by respondents.

and rated as such by the participants of this study, who were not design professionals. Historical architectural details from the periods of the Baroque, the Renaissance and the Secession proved to be significant perceptive elements. In the case of contemporary building (Bremen), the perceptive elements primarily included light and shadow on glazed facades which reflect the shape of the building and can have a considerable impact on the aesthetic of architectural form.[23] Furthermore, the impact of elements like sculptures placed in front of a historic building's entrance (Bremen), can affect the perception of architecture. The valuation of these projects by subjects was an appropriate and necessary supplementation of visual perception analysis. Contemporary buildings in the context of their placement in proximity to historic buildings in Dresden and Bremen were accepted by the respondents and they were seen as matching. In spite of this, the contemporary buildings attracted much less interest and were not as liked as historic buildings. This confirms the justification for conducting eye-tracking studies in conjunction with tools typical of the social sciences. Such studies should prove useful in managing historical city centers. Furthermore, the application potential of the proposed studies in the education of architectural personnel and the historical and architectural education of the public should likewise be noted. We also indicated the purposefulness of proper communication by designers of contemporary development that is to supplement the historical landscape with the public and engaging in measures intended to enhance the knowledge of the past of historical cities among society—specifically in the management of historical zones.

Funding: The eye tracking research and publication was funded from a subsidy given to the Cracow University of Economics and the Cracow University of Technology.

References / Bibliografia

Aletta Francesco, Xiao Jieling, *Handbook of Research on Perception – Dreven Approaches to Urban Assessment and Design*, 2018.

Current Trends in Eye Tracking Research, ed. Horsley Mike, Toon Natasha, Knight, Bruce A., Reilly Ronan, Cham 2014.

De la Fuente Suárez Luis Alfonso, *Subjective experience and visual attention to a historic building: A real-world eye-tracking study*, "Frontiers of Architectural Research" 2020, Vol. 9, iss. 4, p. 774–804.

Dülberg Angelika, Oelsner Norbert, Pohlack Rosemarie, *Das Dresdner Residenzschloss*, *Deutscher Kunstverlag*, Berlin–München 2009.

Furtak Marcin, Kobylarczyk Justyna, Kuśnierz-Krupa Dominika, *Concrete in adaptations and extensions of historic objects (on selected examples from Porto)*, „Wiadomości Konserwatorskie – Journal of Heritage Conservation" 2019, No. 58, p. 15–22.

Gyurkovich Mateusz, *Selected examples of the transformation of post-industrial complexes*, „Wiadomości Konserwatorskie – Journal of Heritage Conservation" 2019, No. 57, p. 142–157.

Historischer Neumarkt Dresden e. V. Aufbau Altsttadt Dresden: Quartier VIII, https://archiv.neumarkt-dresden.de/quartier8.html.

Holmqvist Kenneth, Andersson Richard, *Eye-tracking: A comprehensive guide to methods*, *paradigms and measures*, Oxford 2017.

ICOMOS. Charter for the Conservation of Historic Towns and Urban Areas, https://www.icomos.org/charters/towns_e.pdf, 1987.

Junker Dirk, Nollen Christian, *Mobile eye tracking in landscape architecture: Discovering a new application for research on site*, [in:] *Landscape Architecture – The Sense of Places, Models and Applications*, ed. Amjad Almusaed, London 2018, p. 45–66.

Kunst Im Öffentlichen Raum Bremen. Affentor, 2007, Jörg Immendorff, https://www.kunst-im-oeffentlichen-raum-bremen.de/en/works/affentor-2007-mitte-art1752kior.html.

Lisińska-Kuśnierz Małgorzata, Krupa Michał, *Eye tracking in research on perception of objects and spaces*, "Czasopismo Techniczne" 2018, No. 12, p. 5–22.

Lisińska-Kuśnierz Małgorzata, Krupa Michał, *Suitability of Eye Tracking in Assessing the Visual Perception of Architecture-A Case Study Concerning Selected Projects Located in Cologne*, "Buildings" 2020, Vol. 10, p. 1–24.

Löffler Fritz, *Das alte Dresden – Geschichte seiner Bauten*, Leipzig and Frankfurt 1994.

Noland Robert B., Weiner Marc D., Gao Dong, Cook Michael P., Nelessen Anton, *Eye-tracking technology*, *visual preference surveys*, *and urban design: Preliminary evidence of an effective methodology*, "Journal of Urbanism: International Research on Placemaking and Urban Sustainability" 2017, No. 10, p. 98–110.

Reconnecting the City: The Historic Urban Landscape Approach and the Future of Urban Heritage, ed. Francesco Bandarin, Ron Van Oers, 2015.

Rusnak Marta, Szewczyk Joanna, *Eye tracker as innovative conservation tool. Ideas for expanding range of research related to architectural and urban heritage*, "Wiadomości Konserwatorskie – Journal of Heritage Conservation" 2018, No. 54, p. 25–35.

Schubert Horst Architekten. Fassade Hotel am Schloss, https://schubert-horst.de/fassade-hotel-am-schloss/.

Spanjar Gideon, Suurenbroek Frank, *Eye-Tracking the City: Matching the Design of Streetscapes in High-Rise Environments with Users' Visual Experiences*, "Journal of Digital Landscape Architecture" 2020, No. 5, p. 374–385.

Sparkasse Bremen, 175 Jahre Zukunft. Ein Blick zurück nach vorn: Die Sparkasse in Bremen 1825–2000, Bremen 2000.

Sussman Ann, Ward Janice M., *Eye-tracking Boston City Hall to better understand human perception and the architectural experience*, "New Design Ideas" 2019, No. 3 (1), p. 53–59.

Syndram Dirk, Ufer Peter, *Die Rückkehr des Dresdner Schlosses*, Dresden, 2006.

Tobii. User Manual-Tobii Studio; Version 3.2. Rev A; Tobii Technology AB: Stockholm, Sweden, 2012.

UNESCO. Operational Guidelines for the Implementation of the World Heritage Ban *Convention*, https://whc.unesco.org/document/163852, 2019.

UNESCO. Recommendation on the Historic Urban Landscape, https://whc.unesco.org/uploads/activities/documents/activity-638-98.pdf. 2011.

---

[1] *ICOMOS. Charter for* the *Conservation of Historic Towns and Urban Areas*, https://www.icomos.org/charters/towns_e.pdf (accessed: 10 I 2021).

[2] *Reconnecting the City: The Historic Urban Landscape Approach and the Future of Urban Heritage*, ed. F. Bandarin, R. Van Oers, 2015; UNESCO. Operational Guidelines for the Implementation of the World Heritage Ban Convention, https://whc.unesco.org/document/163852 (accessed: 10 I 2021); *UNESCO. Recommendation on the Historic Urban Landscape*, https://whc.unesco.org/uploads/activities/documents/activity-638-98.pdf. 2011 (accessed: 10 I 2021).

[3] M. Gyurkovich, *Selected examples of the transformation of post-industrial complexes*, „Wiadomości Konserwatorskie – Journal of Heritage Conservation" (hereinafter: „WK") 2019, No. 57, p. 142–157; M. Furtak, J. Kobylarczyk, D. Kuśnierz-Krupa, *Concrete in adaptations and extensions of historic objects (on selected examples from Porto)*, „WK" 2019, No. 58, p. 15–22.

[4] F. Löffler, *Das alte Dresden – Geschichte seiner Bauten*, Leipzig and Frankfurt, 1994.

[5] A. Sussman, J.M. Ward, *Eye-tracking Boston City Hall to better understand human perception and the architectural experience*,

"New Design Ideas" 2019, No. 3 (1), p. 53–59; L.A. De la Fuente Suárez, *Subjective experience and visual attention to a historic building: A real-world eye-tracking study*, "Frontiers of Architectural Research" 2020, vol. 9, iss. 4, p. 774–804; R.B. Noland et al., *Eye-tracking technology, visual preference surveys, and urban design: Preliminary evidence of an effective methodology*, "Journal of Urbanism: International Research on Placemaking and Urban Sustainability" 2017, No. 10, p. 98–110; G. Spanjar, F. Suurenbroek, *Eye-Tracking the City: Matching the Design of Streetscapes in High-Rise Environments with Users' Visual Experiences*, "Journal of Digital Landscape Architecture" 2020, No. 5, p. 374–385; M. Rusnak, J. Szewczyk, *Eye tracker as innovative conservation tool. Ideas for expanding range of research related to architectural and urban heritage*, „WK" 2018, No. 54, p. 25–35; M. Lisińska-Kuśnierz, M. Krupa, *Eye tracking in research on perception of objects and spaces*, "Czasopismo Techniczne" 2018, No. 12, p. 5–22; M. Lisińska-Kuśnierz, M. Krupa, *Suitability of Eye Tracking in Assessing the Visual Perception of Architecture-A Case Study Concerning Selected Projects Located in Cologne*, "Buildings" 2020, vol. 10, p. 1–24.

[6] D. Junker, C. Nollen, *Mobile eye tracking in landscape architecture: Discovering a new application for research on site*, [in:] Landscape Architecture—The Sense of Places, Models and Applications; ed. A. Almusaed, London, 2018, p. 45–66; K. Holmqvist, R. Andersson, *Eye-tracking: A comprehensive guide to methods, paradigms and measures*, Oxford, 2017; *Current Trends in Eye Tracking Research*, ed. M. Horsley et al., Cham 2014.

[7] M. Lisińska-Kuśnierz, M. Krupa, *Suitability of Eye Tracking*, op. cit.; F. Aletta, J. Xiao, *Handbook of Research on Perception – Dreven Approaches to Urban Assessment and Design*, 2018.

[8] A. Sussman, J.M. Ward, op. cit., p. 53–59; M. Lisińska-Kuśnierz, M. Krupa, *Eye tracking in research on perception*, op. cit., p. 5–22; eidem, *Suitability of Eye Tracking*, op. cit.; D. Junker, C. Nollen, op. cit., p. 45–66; K. Holmqvist, R. Andersson, op. cit., *Current Trends in Eye Tracking Research*, op. cit.

[9] F. Löffler, op. cit.

[10] A. Dülberg et al., *Das Dresdner Residenzschloss*, *Deutscher Kunstverlag*, Berlin–München 2009.

[11] D. Syndram, P. Ufer, *Die Rückkehr des Dresdner Schlosses*, Dresden 2006.

[12] *Historischer Neumarkt Dresden e. V. Aufbau Altsttadt Dresden: Quartier VIII*, https://archiv.neumarkt-dresden.de/quartier8.html (accessed: 10 I 2021); *Schubert Horst Architekten. Fassade Hotel am Schloss*, https://schubert-horst.de/fassade-hotel-am-schloss/ (accessed: 10 I 2021).

[13] Ibidem.

[14] Ibidem.

[15] *Sparkasse Bremen*, op. cit.

[16] K. Holmqvist, R. Andersson, op. cit., *Current Trends in Eye Tracking Research*, op. cit.

[17] M. Lisińska-Kuśnierz, M. Krupa, *Eye tracking in research on perception*, op. cit., p. 5–22; eidem, *Suitability of Eye Tracking*, op. cit.

[18] *Tobii. User Manual—Tobii Studio*; Version 3.2. Rev A; Tobii Technology AB, Stockholm 2012.

[19] M. Rusnak, J. Szewczyk, op. cit.; M. Lisińska-Kuśnierz, M. Krupa, *Eye tracking in research on perception*, op. cit.

[20] *Tobii. User Manual*, op. cit.

[21] A. Sussman, J.M. Ward, op. cit., p. 53–59; M. Lisińska-Kuśnierz, M. Krupa, *Suitability of Eye Tracking*, op. cit.; D. Junker, C. Nollen, op. cit.

[22] *Tobii. User Manual*, op. cit.

[23] M. Lisińska-Kuśnierz, M. Krupa, *Suitability of Eye Tracking*, op. cit.

Abstract

The paper discusses the perception and acceptance rating of contemporary buildings sited in historic landscapes of the German cities of Dresden and Bremen, which are an important issue from the perspective of the conservation of historic cities. The study presented in the paper was performed using the eye tracking method. Apart from the social and medical sciences, oculographic methods are also entering use in the study of architecture and urban planning. The application potential of such studies is noted increasingly frequently. The study demonstrated that the cases of contemporary architecture that supplement development in the historic landscape under study, and which the architectural community considers to be successful and to harmoniously blend in with the extant cultural context, were not perceived and rated as such by respondents who were not design professionals. The subjects noted and displayed interest only in some elements of buildings, primarily historic ones.

Streszczenie

W artykule omówiono postrzeganie i ocenę akceptacji współczesnych budynków usytuowanych w historycznych krajobrazach niemieckich miast Drezna i Bremy; zagadnienie to jest ważne z punktu widzenia ochrony miast zabytkowych. Przedstawione w artykule badania wykonano metodą eyetracking. Oprócz nauk społecznych i medycznych, metody okulograficzne znajdują zastosowanie w badaniach architektury i urbanistyki. Coraz częściej zwraca się uwagę na ich potencjał aplikacyjny. Badanie wykazało, że realizacje współczesnej architektury, uzupełniające zabudowę w badanym krajobrazie historycznym i uważane przez środowisko architektoniczne za udane i harmonijnie wpisujące się w istniejący kontekst kulturowy, nie były tak samo postrzegane i oceniane przez respondentów niebędących profesjonalistami. Badani dostrzegali i wykazywali zainteresowanie tylko niektórymi elementami budowli, głównie zabytkowych.