

FRIENDLY CITY. MAKING ARCHITECTURAL HERITAGE ACCESSIBLE

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Abstract

The “Friendly City” Project (FCP) supports the blind and visually impaired (BVI) people to perceive the local architectural heritage in Lodz city in Poland. The multidisciplinary project aims on promoting the accessibility of architectural heritage to the BVI community by adding Audio Descriptions (AD) to 85 public places. The ADs in FCP are guided by insights from an eye tracking study on the perception of architecture by novices and experts, and interviews with BVIs from the Lodz association. The project supports the independence of movement of BVI people in the city center using public transport by installing 200 Bluetooth beacons on city stops and in public places. The beacon devices communicate with smartphones of BVIs and sighted people via a mobile application. The system and applications for FCP are designed with the principles of universal user-centered design. The signals will help BVIs to locate the stop with voice messages about the distance and location.

Keywords: Cultural heritage; Visually impaired; Accessibility systems; Audio description; Eye tracking

Introduction

The Act of 19 July 2019 on Ensuring Accessibility for Persons with Special Needs [1] has opened up a new perspective of activities aimed at this audience. On the example of selected grant and project tasks carried out by a team of researchers from the University of Lodz and the SWPS University in Warsaw, the possibilities of architectural, information and communication and digital accessibility will be outlined, which are examples of good practice in the popularisation of cultural goods. The ongoing research work stems from the grant “Lodz art against the background of European art. Excluded/Included” implemented in Lodz and the Lodz Voivodeship from 2019 to 2023 [2, 3]. Extensive consultations with groups of people with sensory disabilities (a total of 750 people) and with museum curators and educators made it possible to diagnose the needs of visually impaired communities in contact with the historic architecture of the city of Lodz [4]. The result of the implementation of facilities for visually impaired people, but also for all those willing to use the proposed digital accessibility solution is the “Friendly City” Project.

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Architectural Heritage in a “Friendly City” Project and AD

As part of the project, 85 sites were selected to create audio descriptions (AD) that reflect the most important monuments of the city, that started its development in the 19th century. AD is a special narrative that turns what can be seen into what can be heard [5]. It has been developed primarily for blind and visually impaired (BVI) people. It has been shown that sighted people also benefit from AD [6]. AD as an accessibility tool enables the BVI to gain insight into visual scenes by describing their important elements. The group of buildings subjected to AD is diverse in terms of the architectural and stylistic forms used and the function or historical context of their construction. They constitute a representative group of buildings outlining the multicultural heritage of industrial Lodz. Dominant among them are architectural structures that constitute 78 examples of various functions: public buildings, tenement houses, factory residences, and temples. The list does not, however, omit elements equally important for building the city's contemporary identity, such as sculptures or murals [7-9]. The objects mostly represent the stylistic diversity of the historicist era. There is no shortage of buildings referring to Renaissance, Mannerist, or Baroque forms. There are also eclectic buildings and buildings with Art Nouveau motifs. The list also includes modernist and socialist-realist buildings [10]. Care has also been taken to present buildings from the period of the People's Republic of Poland, as well as newer ones erected in the last decade and building the current image of the city, such as the Central Tram Station - the 'Unicorn Stable' (Fig. 1). Such selection allows the construction of a broader, contextual narrative of the place.



Fig. 1. Central Tram Station - the 'Unicorn Stable'. Photo by: D. Rutkowska-Siuda, 2023

The structure of AD's architectural descriptions is divided into several sections. This allows the user a multi-threaded and multi-layered perception tailored to their individual needs and preferences. In addition to the basic AD of an object, a separate section contains additional information that broadens the historical and contextual knowledge (about the architects, the style of the objects), presents detail descriptions and introduces the professional terminology of art history in an accessible way [11]. This formula allows not only to "explore" the structure of an object, but also to place it in the wider context of the city's heritage. Many of the selected buildings, over the years have performed important functions, which have been signalled by the detailing, such as in the house with the Gutenberg sculpture (86 Piotrkowska Street), which was the seat of the first German-language newspaper „Lodzer Zeitung” (Fig. 2). The individual

buildings interconnect to represent the architectural development of the city. Listening to one of the 360° ADs, we will learn about St. Martin's Evangelical Church or the Geyer family and their White Factory, which currently serves as the Central Museum of Textiles in Lodz (Fig. 3).



Fig. 2. Tenement House at Piotrkowska 86. Photo by: D. Rutkowska-Siuda, 2023



Fig. 3. White Factory. Photo by: D. Rutkowska-Siuda, 2023

Eye-tracking Research in the Creation of Architectural Heritage Ads

Recently, ADs have often been created by specialists in a particular field, but their attention patterns over architectural artifacts differ significantly from that of the average layperson. Therefore, the novelty of the “Friendly City” Project is the deliberate use of advanced eye-tracking research in order to achieve a message that most closely matches the actual interests of the AD audience. Through the use of eye-tracking research, the audio descriptions created will most closely replicate the natural way of seeing historic objects, helping to create descriptions that reflect a typical person's view [12, 13], (Fig. 4).



Fig. 4. Grand Theatre, exemplary records of attention scanpaths while viewing a work of Łódź architecture by one person. The circles represent eye fixations (the bigger the circle is the longer fixation duration was) and connections between them represent saccadic eye movements

The research is conducted both in the laboratories of the SWPS University in Warsaw and, with the use of mobile eye-tracking equipment (Pupil Labs Invisible) in Łódź. These activities, combined with feedback from visually impaired people, enable the creation of AD descriptions that are interesting and responsive to the real needs of BVI audiences.

Cultural Heritage of Łódź - an Overview and Issues in Preservation

The architectural heritage of Łódź has evolved very dynamically over the past 200 years. A full understanding of the historic resource allows for the appropriate selection of protection forms and methods of its dissemination. The characterisation of the specifics of urban development, predisposing the shaping of buildings in relation to the cultural and historical development of the city, is essential for understanding the applied selection of sites chosen for analysis in the “Friendly City” Project.

Łódź is a centre of a very stylistically compact historic fabric, containing architectural buildings mostly from the late 19th and early 20th centuries [14]. When the centre was given the rank of an industrial city in 1821, the process of its transformation from a settlement with provincial rural buildings to a textile production centre dominating in the area of the Kingdom of Poland began. The urban layout - of an Enlightenment character with regular plot divisions - was developed very quickly as its basic structure was in place by the end of the 1820s. Its main axis connecting the old Łódź with the New Town and the Łódka River is Piotrkowska Street [15] - today still the city's most important street (Fig. 5).

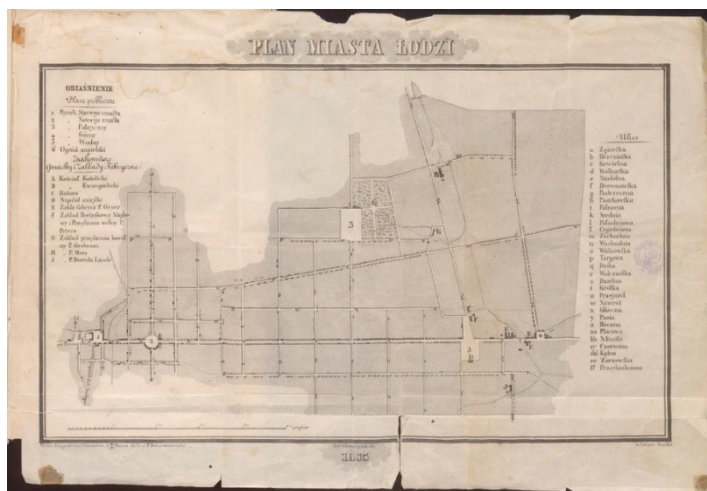


Fig. 5. Plan of the city of Lodz. Oscar Flatt, Description of the city of Lodz, Warsaw 1853. Polish National Library, Public Domain

The chequered street grid allowed to delimit regular quarters for craft and industrial buildings [16]. This layout is to this day a distinctive feature of Lodz in comparison to other centres expanding in the 19th century in Poland. Parallels in terms of the forms applied and the pace of development are often visible with English (Manchester) or American (New York) cities. Today, the legibility of the plan also makes it easier for visually impaired people to move around the city. At the same time, the 19th-century urban layout concentrates the most important historical buildings representative of the textile centre in a relatively small area. 360° descriptions have been devoted to the important points of the city's development.

The first period of the city's spatial development is characterised by the layout of the Old Market Square with a description of the Church of the Assumption of the Blessed Virgin Mary and the Old Town Park. The former clothmakers' area of Lodz is presented by the description of the New Town with the buildings located on Liberty Square (plac Wolności) - the Church of the Holy Spirit, the Town Hall, the Kościuszko Monument and the building of the former Higher School of Crafts (now the Archaeological and Ethnographic Museum). Industrial areas are represented by the descriptions of the White Factory, Księży Młyn and their surroundings.

The small-town character of the centre with its predominantly wooden buildings was maintained until the 1850s. This was clearly indicated by the first monographer of Lodz, Oskar Flatt: *The long, regular, busy panoramas show an eye-shaped line of, for the most part, low, brick monolithic houses starting from the market square in the New Town [...] and running in a long line as far as the factory district* [17]. The dominant role in the city's image at the time was played by the wooden or brick stylized weavers' cottages and one- and two-storey houses with simplified neo-Renaissance stucco decorations. The more representative edifices were located in the New Town square - the town hall, the Evangelical church (Fig. 6). The building process continued until the 1860s. After overcoming the so-called cotton crisis in 1861-1863, Łódź entered a period of intensive industrialisation. This was associated with an increase in population, arriving especially after 1864, as a result of the enfranchisement reform introduced by the Tsar.

There was a need to divide the quarters, to increase the density of housing, which resulted in the creation of, for example, Kamienna Street or Spacerowa Street, also known as Promenada (now Kościuszko Avenue) [18]. An additional impulse for the development of urban buildings was the connection of the centre with the Warsaw-Vienna railway in 1864 (Figs. 7a and b), which resulted in more intensive development of the eastern area between Dzielna Street (currently Narutowicza Street) and Przejazd Street (currently J. Tuwima Street). In the architectural

descriptions of the Project, the specifics of the development of this area focus on the presentation of representative buildings on T. Kościuszko Avenue, such as: the M. Pinkus Tenement House, the Jakub Hertz Palace, the Wilhelm Lurkens Palace, the Building of the former German Reformed Gymnasium; or A. Struga Street: the I. Auerbach's Tenement House, the Tenement House of the Łódź Loan and Savings Society.



Fig. 6. New City Market in Łódź. Oscar Flatt, *Description of the city of Łódź*, Warsaw 1853. Polish National Library, Public Domain



Fig. 7. Łódź Fabryczna railway station: a. postcard from the beginning of the 20th century (Polish National Library, Public Domain, ref. DŻS XII 8b/p.10/14); b. Current appearance of the Łódź Fabryczna railway station. Photo by: D. Rutkowska-Siuda

The period from the 1870s to the outbreak of the First World War was particularly important for the construction of the city's current image. Urban development took on a metropolitan character, where the main part of the representative frontages were several-storey tenement houses with outbuildings extending into the plot. This area was closed by a transverse outbuilding. This type of courtyard studios is visible in the developments in Dzielna Street (currently Narutowicza), Cegielniana Street (currently Jaracza) or Piotrkowska Street (Fig. 8). AD's descriptions of this diversity are presented in the descriptions of buildings in Piotrkowska Street such as: the Scheibler's, Dawid Sendrowicz's or Poznański's tenement house. In the developing multicultural centre there was also the construction of churches and houses of prayer, as presented in the descriptions of e.g. the Orthodox Church of Alexander Nevsky, St Marcin's Church or St Stanisław Kostka's Church [19].



Fig. 8. Piotrkowska Str. at the beginning of the 20th century, postcard. Library of the University of Lodz, ref. pocz. 74

The growing enterprises of Karol Scheibrel, Izrael Poznanski, Henryk Grohman, Juliusz Heinzl, Juliusz Kunitzer or Robert Biedermann influenced another characteristic aspect of the city's development. They formed factory-residential complexes. They consisted of: the owner's residence surrounded by a garden, factories and flats for workers, as it is the case, for example, in the presented descriptions of Ogrodowa Street with Poznański's mansions or in Księży Młyn [20]. There were also smaller structures - city palaces and villas, such as the palaces of Izrael and Maurycy Poznański on Gdańska Street, Alfred and Robert Biedermann on Kilińskiego Street, the Steinerts, or Juliusz Heinzl on Piotrkowska Street (Fig. 9).

A particular building boom can be seen in the interwar period. In 1919 Łódź became a provincial city and the diocese of Łódź was also established. As a result, the city in the now independent Poland undertook a number of construction initiatives giving the city a modern character. Important was the construction of public facilities such as a court, hospitals and schools. This period is represented in the descriptions by the development of Dąbrowskiego Square and Sterling and Narutowicza Streets. The development of the eastern part of Łódź introduced a new type of buildings with modernist forms, monumentalised and devoid of detail, an example of which is the former seat of the Waterworks and Sewage System Department (currently the seat of the Art History Institute at the University of Łódź) (Fig. 10).



Fig. 9. View of the back of Juliusz Heinzel's palace at Piotrkowska 104 (currently Komuny Paryskiej Square). Hilary Majewski, [Łódź XIX w.], 1890, from the collection of the Library of the University of Lodz



Fig. 10. Building of the Department of Sewerage and Waterworks in Lodz, 1938. Polish National Digital Archives, Public Domain, ref. 1-G-6595

The brief outline of the city's development makes it possible to identify a number of important architectural landmarks. The protection of 19th century neo-style and Art Nouveau architecture, and industrial architecture in particular, only became feasible in the 1970s, when its stylistic value was appreciated. The domain of recent decades, on the other hand, has been the defence of modernist buildings. The last 50 years have been a long and arduous period of saving hundreds of buildings. The primary form of legal protection is to include a building in the register of immovable monuments. Equally important is the inclusion of contemporary valuable architectural buildings in the city's development plans. In the "Friendly City" Project, these buildings are also reflected in the description of the Textile Centre Tower, the 'Magda' Department Store and the University of Lodz's Library, among others.

Conservation care and their constant supervision coupled with popularisation activities are carried out by the National Heritage Institute (with its branch in Lodz) [21]. The image of Lodz's

architecture has been improved in recent years through a number of revitalisation projects, e.g. in post-industrial areas such as Manufaktura, Off Piotrkowska, Księży Młyn [22], and urban buildings, e.g., as part of the 'City of Tenements' Project (since 2011) [23]. A noteworthy initiative was the creation of the Lapidarium of Detail at the Office of the City Architect, operating since 2020, which collects elements from buildings undergoing conservation or being demolished; the facility popularises knowledge about the city and its monuments through exhibitions and displays of detail. Particularly important and helpful in the care of Lodz's monuments was the Decree of the President of the Republic of Poland of 16 February 2015 on the recognition of 'Lodz - multicultural landscape of an industrial city' as a historical monument" [24]. The historic area so designated, which has historical, artistic and scientific value, became the starting point for shaping the map of "Friendly City" sites.

Accessibility of Architectural Space in Lodz

Accessibility of architecture for people with disabilities has always been a major challenge [25]. Since the introduction of the Accessibility Act, this issue has become even more highlighted by a bunch of experts [26]. The search for solutions that can realistically improve the accessibility of historic architectural buildings is now a burning issue [27]. This is due to the need to find compromises between the conservator, who cares for the valuable fabric of the building, the legislator, who introduces legal restrictions, and the owner of a given building, who is its main user [28]. The analysis of buildings and the scale of their adaptation is always considered on an individual basis, making it difficult to introduce schematic methods or patterns of action. The issues mainly revolve around the accessibility of communication systems (no thresholds, lifts, etc.), which is a major challenge with historic buildings, as changes may disrupt the original communication routes or alter the external appearance of the building (an external lift - changes the perception of the mass, modifying the width of the entrance changes the proportions in the decoration). It is much simpler to make extensive changes to historic buildings currently serving a public function than to buildings owned by private investors. In the interdisciplinary "Friendly City" Project, we aim to present an alternative form of architectural heritage accessibility that is non-interfering with the structure of the building, targeted specifically at the BVI community through the use of AD descriptions correlated with an audio tagging system and a mobile app.

The Totupoint system's electronic markers are mounted as part of the project on the outside of buildings near the entrance doors. Its power supply is wireless (using Bluetooth Low Energy technology), which is of particular importance in the context of historic architectural facades, as it does not disfigure or interfere with the overall reception and does not place an additional burden on the building's electrical system. Mounting the marker also does not force interference with the facade face, as it permanently adheres to the surface using only mounting tapes. The small size of the prism-shaped Totupoints does not exceed 11.5 x 6.1 x 5.5cm and weighs 0.3kg (Fig. 11). To better match the façade colour, the project uses three colours: white, light grey and dark grey. The installed markers are thus practically invisible, which means that their use in the case of historic buildings does not pose a threat to the building (Fig. 12 and 13). A small number of Totupoints are already in place in Lodz on buildings forming part of the infrastructure of the University of Lodz [29]. In cooperation with the Roads and Transport Authority in Lodz, 200 markers will be added to the infrastructure, mainly located at public transport stops in Lodz (bus and tram shelters and stops). This correlation should have a positive impact on increasing the mobility and independence of the BVI or elderly people who want to actively participate in the social and cultural life of the city [30].



Fig. 11. Electronic markers using the Totupoint system.



Fig. 12. Markers visible on the buildings of the University of Lodz on ul. Narutowicza 65 and 68.



Fig. 13. Grand Theatre in Lodz – entry, totupoint mounting proposal, D. Rutkowska-Siuda, 2023

For decades, architectural barriers in urban space have been barriers to even everyday life for BVI people. Currently, the space of Lodz is undergoing a systemic infrastructural change.

Intensive renovation works in the very centre of Lodz are currently hampering the installation of markers at bus stops, e.g., at Wolności Square (Fig. 14). Bus and tram routes are undergoing numerous changes, which will translate into an increase in the number of bus stops in the future. In the coming years, the urban space covered by the project will become even more accessible and user-friendly for people with impairments.



Fig. 14. Plac Wolności [Liberty Square].

Prospects for System Development and Support for BVI Citizens in Lodz

What distinguishes the “Friendly City” Project from other global initiatives is its intense focus on promoting accessibility in the external environment. The project aims to enable the implementation of project solutions in other agglomerations as well. The project is intended to benefit not only visually impaired people, but also tourists. In an effort to create an information and communication system that is friendly and accessible to users with impairments, we have taken a number of steps in design, including:

- development of functional and non-functional needs;
- surveys and meetings with audiences, BVI and city representatives;
- designing use cases for mobile applications;
- designing the cloud backend and testing it with several of the most popular clouds;
- designing the AD management system.

During the design of the solution for the “Friendly City” Project, we had several sessions with BVI beneficiaries and representatives of the City of Lodz. We implemented the conclusions from the interviews into the design of the AD descriptions on an ongoing basis.

The main objective of the system is to significantly support independent movement of people, especially visually impaired people, in the centre of Lodz when using public transport. The implementation of the system will lead to greater social integration and positively influence the quality of life of visually impaired people. The novelty of the system lies in the combination of various methods and techniques supporting the movement and perception of art objects by visually impaired people into a single beneficial research unit: audio description, eye tracking and new technologies in the form of applications for mobile devices (smartphones) [31]. The research methods will be used to create an infrastructure of electronic tags and personal mobile devices that will make blind and visually impaired people independent and active users of the city. To this end, a wireless network of Totupoints will be installed on public transport facilities (e.g. bus stops) and architectural objects (e.g. historic buildings). The small, virtually maintenance-free battery-powered devices will communicate with the smartphones and smartwatches of visually impaired and sighted people via an app. The signal emitted will help

visually impaired people locate, for example, bus stops, stairs, etc. with a prepared voice message about distance and location.

Placing devices at public transport stops that can be detected by the user's mobile application and automatically notify them with an audible signal of the proximity of such a place is a unique solution on a European scale [28]. The functionalities of the solution were tested in a classroom environment [32] with the help of the MIMI methodology [33][34]. None of the existing solutions offers this feature. It should be emphasised that the Road and Transport Authority (ZDIT) and the Municipal Transport Company (MPK) are involved in the activities related to the implementation of the system

The proposed system is based on communication between a smartphone application, a beacon tag, and a database system using known or specially developed APIs. Subsequently, the communication between the mobile application and the back-end system will use a cloud-based back end. The system will be designed according to the principles of universal user-centred design, involving all groups of potential users and stakeholders at every stage of system preparation. We assume that the solutions developed in the project will be easy to implement in other cities, which will improve the quality of life of their inhabitants, increase social integration and allow the recipient to more fully perceive architectural heritage.

Conclusions

One of the main goals of the interdisciplinary project "Friendly City", is presenting an alternative form of accessibility of architectural heritage that does not interfere with the structure of the object. Through the use of audio descriptions correlated with the system of sound markers and applications for mobile devices, it is directed in particular to the visually impaired community.

Audio description, as an accessibility tool that has been established over 15 years ago, enables people with visual disabilities to gain insight into visual scenes by describing their important elements. The group of buildings subjected to AD in Lodz is diverse both in terms of the architectural and stylistic forms used as well as the functions or historical context of their creation. They constitute a representative group of objects presenting the multicultural heritage of industrial city. To make the reception of AD descriptions by users multi-threaded and multi-layered, as well as tailored to their individual needs and preferences, the structure of AD architectural descriptions has been divided into several sections. This allows the user, apart from the basic AD description of the object, to obtain additional information, expanding historical and contextual knowledge (about architects, style of objects), presenting detail descriptions and introducing professional terminology in the field of art history in a manner accessible to the recipient [35, 36]. Such a formula allows not only to "get to know" the structure of the object, but also to place it in the broader context of the city's heritage. What's more, such structure, in accordance with the idea of the "Friendly City" project, allows the application to be widely used by sighted people: tourists and residents interested in the history and cultural heritage of the city.

Both the designed smartphone applications and the structure of descriptions of architectural objects are based on modules, which will allow for their easy implementation in other urban centers. The intention of the creators of the "Friendly City" project, due to its utilitarian and pro-accessibility nature, is to implement the entire system in other towns.

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