MAPPING DIGITAL CULTURAL HERITAGE MUSEUMS IN POLAND

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Purpose: Digital cultural heritage has become inherent to the Polish cultural landscape, as evidenced by the growing attention digital cultural artefacts receive. The research objective is to build a map and list of places where digital cultural heritage artefacts are protected and made available to the public in Poland.

Design/methodology/approach: The article outlines a concept for a 'Tourist Trail of Digital Cultural Heritage in Poland'. The trail links several dozen unique places that bear testimony to the history of technical development and associated socioeconomic phenomena. A pilot study, a partially structured interview survey, was conducted in the Museum of Electronics in Kraków. Having analysed source materials, the author compiled a list and a map of digital cultural heritage museums in Poland.

Findings: The map of the museums revealed a potential market niche and established a 'Tourist Trail of Digital Cultural Heritage in Poland'. The pilot survey revealed that visitors to the Museum of Electronics in Kraków were interested in how archaic digital hardware looked and worked and also what was inside. It is a recommendation on how future museum exhibitions can be set up.

Originality/value: These are the first list and map of places that preserve and promote the memory of digital cultural heritage in Poland. It is also a starting point for the 'Tourist Trail of Digital Cultural Heritage in Poland'. The tourist trail of digital cultural heritage is a unique tourist and cultural product aimed at preserving the memory of Polish and international computer thought.

Keywords: cultural heritage, map of museums, tourist trail, retrocomputing, retrogaming.

Category of the paper: research paper.

1. Introduction

Digital cultural heritage has become inherent to the Polish cultural landscape, as evidenced by the growing attention digital cultural artefacts receive (Rak, Pstrocka-Rak, 2023). In the first half of 2024 alone, two branches of private retrogaming and retrocomputing museums were opened in Poland: the Chorzów branch of the Museum of Electronics in Kraków and the Warsaw branch of the Kraków Arcade Museum (Król, 2024). The media expect similar

initiatives, such as a new museum in Łódź (Retro, 2024). The growing interest in digital cultural heritage and the number of places where digital cultural heritage artefacts are displayed as interactive exhibits lead to the research question about the role of digital cultural heritage museums and where they are the most numerous in Poland. Mapping digital cultural heritage museums in Poland may identify a market niche for new museums by revealing which voivodeships have no museums with digital artefacts, leading to the consideration of the 'Tourist Trail of Digital Cultural Heritage in Poland'.

The research objective is to build a list and map of digital cultural heritage museums in Poland as the underpinning for the 'Tourist Trail of Digital Cultural Heritage in Poland'. The study is part of the research project 'Mapping Digital Cultural Heritage Museums in Poland' (ref. DigiMap; K/658/2024/WRE) founded under the Regional Excellence Initiative scheme, contract No. RID/SP/0039/2024/01. The research topic is covered by the second REI domain: Cultural Heritage Management. It treats cultural heritage, including rural digital cultural heritage (Król, Zdonek, 2024), as a component of multi-functional and sustainable development, a token of entrepreneurship, and an inherent element of the urban cultural landscape.

Although the interest in digital cultural heritage is growing both in Poland and globally (Karp, 2014), there is still great room for improvement regarding the promotion, education, documentation, and preservation of digital artefacts, hardware and software heritage both (Król, 2021). The number of places displaying archaic digital hardware is growing in Poland and internationally. These are mostly grassroots projects established by private collectors and enthusiasts of retrocomputing and retrogaming. This community exhibits several unique characteristics, including 1) commitment: they are not sufficiently compensated for the time they contribute restoring archaic hardware even though many members of the community are or were IT specialists and 2) a high level of expertise: people involved in retrocomputing have expert skills due to their specialist education, experience, and studies or professional experience (Galloway, 2011). The dispersed and individualized nature of digital cultural heritage museums situated all over Poland makes it challenging to build a single consolidated list of such places. Their details can be found online described with various keywords, which does not help, either. This poses a particular research gap worth investigating.

The remainder of the article is structured as follows. Section two sheds light on the notion of the museum institution and how it operates in Poland. It also points out that digital cultural heritage is not just hardware and software but also places, people (communities), and socioeconomic and cultural phenomena. Section three contains the research methodology, and section four offers the results with a list of digital cultural heritage museums and conclusions from the partially structured interviews. Section five provides insights into the functioning of digital cultural heritage museums in Poland and globally. The summary points out that just like tourists are offered such products as wooden architecture routes, they should also be able to follow digital cultural heritage trails.

2. Background

Cultural heritage is a constantly evolving collection of tangible objects and symbols, cultural artefacts, heritage assets, and customs that are relevant to specific communities. Cultural heritage links the past to the future (Thwaites, 2013). It often forms a framework for belonging to a particular community or cultural group. Cultural heritage competence is essential for building and maintaining national, ethnic, or regional identity. Cultural heritage shows us how people have been using natural resources, building communities, and affecting ecosystems, space use, societal transformations, and cultural landscape for ages (Panelli, Tipa, 2007). What is more, knowledge of cultural heritage helps better understand the historical – socioeconomic and cultural – context of today's developments (Thwaites, 2013). This is what Pawlikowski (1959, p. 82) wrote about cultural heritage in 1959: 'Cultural artefacts of the eras gone by may be of great educational value for today's generations as testimonies to the nation's history. As true reflections of life, they shape, inter alia, the awareness of the man today, who finds it easier to learn the external world and comprehend their times thanks to being familiar with embodiments of the past culture.'

In Poland, cultural heritage is associated mostly with sacral objects, folklore, architecture, paintings, and sculptures. But it is not only about collections of things, roadside shrines, or monuments. It also covers traditions and customs handed down between generations, such as oral traditions, performing arts, social practices, rituals, festive events, knowledge and practices concerning nature and the universe, or the knowledge and skills of traditional crafts. Intangible cultural heritage is the 'heritage that is embodied in people rather than in inanimate objects' (Logan, 2007). UNESCO defines intangible cultural heritage as 'the practices, representations, expressions, as well as the knowledge and skills that communities, groups and, in some cases, individuals recognise as part of their cultural heritage' (Intangible Heritage Convention) (UNESCO, 2003).

Tangible and intangible cultural heritage types are complemented by natural and digital heritage. Natural heritage 'refers to natural features, geological and physiographical formations, and delineated areas that constitute the habitat of threatened species of animals and plants and natural sites of value from the point of view of science, conservation, or natural beauty. It includes private and public protected natural areas, zoos, aquaria, and botanical gardens, natural habitat, marine ecosystems, sanctuaries, reservoirs etc.' (UNESCO, 1972). On the other hand, according to the Charter on the Preservation of the Digital Heritage (UNESCO, 2009), digital heritage 'consists of unique resources of human knowledge and expression. It embraces cultural, educational, scientific, and administrative resources, as well as technical, legal, medical, and other kinds of information created digitally or converted into digital form from existing analogue resources. Where resources are born digital, there is no other format but the digital object. Digital materials include texts, databases, still and moving images, audio,

graphics, software and web pages, among a wide and growing range of formats. They are frequently ephemeral and require purposeful production, maintenance, and management to be retained' (UNESCO, 2009, p. 1).

2.1. Digital cultural heritage museums

A museum is a non-profit organisation. Its objective is to collect and permanently protect assets of the natural and cultural heritage of humanity in both tangible and intangible forms, but also to inform about the value and content of the collections, promote fundamental values of history, science, and culture, mould cognitive and aesthetic sensitivity, and facilitate the usage of the collections (Act, 1996, Article 1). According to the International Council of Museums (ICOM, 2022), 'a museum is a not-for-profit, permanent institution in the service of society that researches, collects, conserves, interprets, and exhibits tangible and intangible heritage. Open to the public, accessible and inclusive, museums foster diversity and sustainability. They operate and communicate ethically, professionally, and with the participation of communities, offering varied experiences for education, enjoyment, reflection, and knowledge sharing'.

In Poland, museums can be established by ministers, heads of central offices, local governments, natural persons, corporations, or unincorporated organisations (Act, 1996, Article 5.1). The minister for culture and protection of national heritage keeps a list of museums in the Public Information Bulletin. It contains the museum's name, office address, name of the creator (first and last name for natural persons), and the date the museum was listed in the State Register of Museums – a separate database on museum institutions – if the museum has been registered. The State Register of Museums aims to verify the high level of expertise and importance of the collections and to keep track of museums that meet these conditions. The Act (1996) requires that exhibits be protected and their integrity maintained. Each museum on the list or in the register should regularly and consistently strive to complete and expand the collection as per its policy, restore the functionality of the exhibits, engage in educational and research activities, train museum staff, record and publish history-related materials, and cooperate with parties that might provide support for all these operations (Pstrocka-Rak, Rak, 2021).

Although places where digital cultural heritage is preserved often include 'museum' in their names, they are not always supervised by the Ministry of Culture and National Heritage and listed in the State Register of Museums or the list of museums functioning under a statute or rules approved by the minister for culture and national heritage. The list of museums (List MCNH, 2024) (not to be confused with the State Register of Museums) enumerates the following museums of digital cultural heritage (as on 22.07.2024): 1) the Museum of the History of Computers and IT in Katowice (pending organisation) (item 463); 2) Museum of Computers and Games in Warsaw (pending organisation) (item 800); 3) Museum of Computers and Gaming Consoles in Osielsk (item 794), and 4) National Museum of Technology in

Warsaw (item 355). The list contains data on museums, the statute or rules of which have been approved by the minister for culture and national heritage under Article 6 of the Act on museums of 21 November 1996 (Act, 1996).

2.2. Digital cultural heritage museums as specialist tourism

In general, landscape means 'everything around us' as a combination of attributes constituting a 'real landscape content' that affect the attractiveness of the explored area (Kożuchowski, 2005). One might believe that landscape and cultural landscape are mostly architectural objects in a natural, physical space that establish a 'memory of things' in an urban system, considering that 'cultural memory needs places to be preserved' (Górka, 2011, p. 249). Societal and cultural identities are linked to the awareness of the shared past and enhanced by access to it. The language of spatial forms provides a means for communication and sharing common history (Górka, 2011). ELWRO Square in Wrocław, commemorating Wrocławskie Zakłady Elektroniczne ELWRO from 1959-1993, is a distinct example of digital cultural heritage (Król, 2024).

Landscape is a complex phenomenon unique to a specific space (Nitkiewicz-Jankowska, Jankowski, 2010). In contrast, a cultural landscape embodies the 'socialisation' of the natural environment and its physiognomic expression (Leszczycki, 1977). The cultural landscape emerged as a result of human development and is still shaped by it. Therefore, this landscape has been transformed anthropogenically to such a degree that its continued existence can be secured only by a constant effort of people to keep it in the right state (Nitkiewicz-Jankowska, Jankowski, 2010). Furthermore, a cultural landscape emerges from the activities of multiple generations living in a specific area. Its forms retain the memory of past events, people, and places. The information about the past deposited there is handed down to new generations, which reintroduce them through their own interpretations and depictions (Górka, 2011). One must not forget intangible components of the cultural landscape, including such elements of culture, traditions, and heritage that have no physical form and yet significantly affect the shape and understanding of the specific cultural landscape. Evidently, landscape qualities can substantially affect various branches of tourism and the growth of entrepreneurship or, more broadly, socioeconomic and cultural development.

Landscape qualities are usually divided into recreational, tourist (natural and cultural), and specialist. The latter is considered the most important primary motive for travel. There is a certain specialist group of people who can be referred to as specialist tourists with knowledge of archaic (digital) computer hardware and an interest in technology history, retrogaming, and retrocomputing. The presence of a museum of technology or digital cultural heritage may be a driver of tourist activity and stimulate the tourism industry in the region. Digital technologies can be employed to create new artistic and cultural forms, such as digital art, computer games, films, animations, and various interactive media. These forms become part of today's cultural landscape. As a result, digital cultural heritage is not just an accessory

to traditional heritage but plays a critical role in shaping the modern cultural landscape (Król, Hernik, 2022), driving its dynamic development and enhancement. Moreover, digital cultural heritage is an 'extension' of the natural ecosystem. The author believes that the digital ecosystem exhibits more similarities to the natural one that might at first appear, but not vice-versa. It means that the digital ecosystem, more precisely the online ecosystem, exhibits numerous analogies to the natural ecosystem. One could even risk a thesis that the digital (online) ecosystem is built according to principles similar to the natural ecosystem. Digital cultural heritage museums preserving archaic hardware and software are positioned at the interface of natural and digital spaces. The growing number of such places shows that they have become an inherent part of the cultural landscape, especially in urban areas where the Polish computer thought developed (Maćkowiak et al., 2018).

3. Materials and methods

The research was conducted under the Mapping Digital Cultural Heritage Museums in Poland (DigiMap) project, REI project No. K/658/2024/WRE. The project is part of action 2.1 'Funding for mini-research projects. Support for management research and development relevant to regional socioeconomic environment'. The present study is part of a main project, 'Improved potential of management and quality sciences through better use of Polish rural capital', co-founded by the Republic of Poland under a Minister of Science scheme, 'Regional Excellence Initiative'. A popular-science description of the research in Polish, a raster map, and an interactive map of the museums of digital cultural heritage in Poland, together with preliminary conclusions and results of a pilot study, were published on the website of the author and leader of DigiMap: http://digitalheritage.pl/. This article includes fragments of original works by the author published as white papers on the above-mentioned website.

The first stage involved study visits to selected digital cultural heritage museums where the author took photographs. The second stage was a partially structured interview survey. It involved curators (n = 2) at the Museum of Electronics in Kraków and Gen Z representatives who visited the museum for the first time (n = 7). The response sheets have been archived and are kept by the author.

The third main stage was a survey of facilities that preserve, display, and promote digital cultural heritage artefacts and places where the history of the Polish computer thought is documented and preserved. The focus was on organizations that display archaic electronics and software, host exhibitions of digital cultural heritage, and/or restore digital artefacts. The inventory was taken according to the list of museums kept by the Ministry of Culture and National Heritage of Poland (List MCNH, 2024) and scientific and popular science literature. In addition, online search engine searches were an important part of the work. The following

keywords in various combinations were used, some of them in Polish: 'muzeum gier' (museum of games), 'retrogaming', 'retrocomputing', 'muzeum arcade' (arcade museum), and 'muzeum flipperów' (pinball museum). The inventory is presented on (analogue and interactive) maps and as a table. During the research process, the author noticed that the 'Tourist Trail of Digital Cultural Heritage in Poland' emerged from the locations of the museums of digital cultural heritage.

4. Results and conclusions

4.1. Inventory of museum institutions

As on 5 August 2024, the author identified 33 places in total, including museums and para-museum institutions involved in the protection of digital cultural heritage artefacts found in publications (scientific and popular science literature), public space, and the media. The greatest number of places of digital cultural heritage was found in urban agglomerations: Kraków, Warsaw, and Łódź. The voivodeships with the largest populations of museums of digital cultural heritage are Małopolskie, Dolnośląskie, Łódzkie, and Mazowieckie (Table 1). Their locations make up the digital cultural heritage trail starting in southern Poland and winding all the way up north to Pomerania.

Table 1.
Tourist Trail of Digital Cultural Heritage in Poland*

Voivodeship	List of museums
Małopolskie	a. RetroManiak – Muzeum Zabawek i Gier Komputerowych (Museum of Toys and Computer Games RetroManiak), Zakopane b. Muzeum Elektroniki w Krakowie (Museum of Electronics in Kraków) c. Kraków Pinball Museum d. Kraków Arcade Museum e. Muzeum Inżynierii i Techniki w Krakowie (Museum of Engineering and Technology in Kraków)
Śląskie	a. Muzeum Historii Komputerów i Informatyki w Katowicach (Museum of the History of Computers and IT in Katowice) b. Muzeum Elektroniki w Chorzowie (Museum of Electronics in Chorzów) c. FunHouse Katowice
Opolskie	a. Klubowe muzeum retro komputerów, gier i demosceny w Opolu (Club Museum of Retrocomputers, Games, and Demoscene)
Dolnośląskie	a. Prywatne Muzeum Konsol Gier Video w Karpaczu (Private Museum of Consoles, Video Games in Karpacz) b. Laboratorium Retro Komputerów i Gier w Legnicy (Laboratory of Retrocomputers and Games in Legnica) c. Muzeum Gry i Komputery Minionej Ery (Museum Games & Computers of the Past Era), Wrocław d. Wirtualne Instytutowe Muzeum Komputerów Politechniki Wrocławskiej (Institute Virtual Museum of Computers of the Wrocław University of Technology) e. ELWRO square and memorial obelisk**

Cont. table 1.

Łódzkie	a. Muzeum Komputerów Osobistych w Łodzi (Museum of Personal Computers in Łódź)
	b. Centrum Komiksu i Narracji Interaktywnej EC1 w Łodzi (Centre for Comics & Interactive Narration EC1 in Łódź)
	c. Retro Gaming Club Łódź
	d. Muzeum Komputerów i Gier w Pabianicach (Museum of Computers and Games in Pabianice)
Mazowieckie	a. Milanowskie Muzeum Gier i Komputerów (Milanówek Museum of Games and Computers)
	b. Interaktywne Muzeum Flipperów Pinball Station (Interactive Museum of Pinball Machines Pinball Station)
	c. Warszawskie Muzeum Komputerów i Gier (Warsaw Museum of Computers and Games)
	d. Apple Museum Poland***
	e. Narodowe Muzeum Techniki w Warszawie (National Museum of Technology in Warsaw)
	f. Warszawskie Muzeum Arcade (Warsaw Arcade Museum)
Kujawsko-pomorskie	a. Muzeum Uniwersyteckie UMK w Toruniu (IT Museum of the Nicolaus Copernicus University)
	b. Muzeum Konsol i Gier Wideo w Bydgoszczy (Museum of Consoles and Video Games in Bydgoszcz)
Zachodnio-pomorskie	a. Cyfrozaury. Komputery z poprzedniej epoki (Digisaurs. Computers from the Previous Era), Szczecin
Pomorskie	a. Flipper Stacja Gdańsk – Pinball & Arcade Games Room (Pinball Station Gdańsk)
	b. PIXELMANIA, Władysławowo
Warmińsko-mazurskie	a. Arcade Classics Muzeum w Elblągu. Museum of 1990s Video Games in Elbląg
Podlaskie	a. Sokólskie Muzeum Gier Retromania (Sokółka Museum of Games Retromania)
Wielkopolskie	a. ATARI Muzeum in Poznań
	b. Centrum Szyfrów Enigma w Poznaniu (Enigma Cipher Centre in Poznań)

*The locations of the places listed here are shown on static and dynamic maps entitled 'Towards a Digital Cultural Heritage Trail in Poland'. The list and map were created under the Mapping Digital Cultural Heritage Museums in Poland (DigiMap) project under REI project No. K/658/2024/WRE. The map is an original work by the author published at DigitalHeritage.pl (http://digitalheritage.pl/2024/04/18/szlak-dziedzictwa-cyfrowego/) (published: 18.04.2024, revision: 10.08.2024). DigitalHeritage.pl is a proprietary website of the author.

**The square is not a museum. It 'commemorates a company whose computers blazed the IT trail in Poland in the second half of the twentieth century' (elwrowcy.pl).

***The museum is being reorganised and moved (as on 10.08.2024).

Source: original work.

Kraków is the most densely populated with museums of digital cultural heritage. Four unique museums with interactive exhibitions of digital cultural heritage are situated relatively close to each other there (downtown Kraków and close to the city centre). Moreover, Katowice, with its Museum of the History of Computers and IT, is not very far from Kraków, a must-see according to retro-IT enthusiasts.

Northern Poland has slightly fewer and more apart museums of digital cultural heritage. Kraków is a great starting point for the 'Tourist Trail of Digital Cultural Heritage in Poland' because of the reputation of its museums, which not only are interactive but also offer an extensive exhibition of various types of hardware, including consumer electronics, not just video game consoles or computers. Note that some of the places on the map are university exhibitions. What is more, some exhibitions are temporary. It is very relevant to visitors' plans.

Museum mapping revealed a potential market niche. The static and interactive maps have been published on the author's website DigitalHeritage.pl. No mention of museums of digital cultural heritage in Świętokrzyskie, Lubelskie, and Podkarpackie Voivodeship, that is south-eastern Poland, or Lubuskie and Wielkopolskie Voivodeships was found in publications or media reports (as on 10.08.2024). Lack of competition may encourage entrepreneurs to open a similar museum in these voivodeships.

4.2.   Results of the pilot survey

The respondents approached the questions in various ways. Some answers were excessively economical, while others were extensive. Despite the relatively small sample, the survey revealed some novel suggestions of use to curators of digital cultural heritage museums. The structured interviews with the curators shed light on the problems of private museums of digital cultural heritage in Poland. Note that the survey questions were mostly open-ended because the research is based on qualitative, structured interviews, not the quantitative approach.

Seven representatives of Gen Z were interviewed (aged 19-26). Of those visitors to the Museum of Electronics in Kraków who agreed to participate in the study, six were women and one was a man. All of them were first-time visitors to the museum and highly enjoyed their first impressions. Four of them assessed their impressions as good (score 4 out of 5) and three as very good (enthusiastic perception). All the participants found the large number of items and their diversity, combined with interactions with the exhibits and stories told by the curators, to be the most impressive. They were very interested in retrogames, which they believed offered 'an opportunity to go back in time', 'a return to one's childhood', and 'associations with childhood'. Highly interesting exhibits included vacuum-tube radios and telephones. For two respondents, it was the first time they came across 'computers in the form of a keyboard' (such as the Atari) and pinball machines. However, museum visitors come with various expectations. For example, two of the respondents hoped for more insight into everyday objects rather than computer games.

What the respondents imagined would be in the Museum of Electronics differed from what they experienced. One of the respondents shared their story: 'Before I came here, I imagined a small museum with nothing to write home about, where you mainly listen to a guide. The reality was completely different.' The respondents were not expecting 'hands-on' exhibits and a 'casual, homely atmosphere'. One respondent found a passionate curator particularly engaging. The interviews revealed that the respondents were interested in the workings of the antique objects, the mechanisms, designs, and technical details. The respondents unanimously agreed that the visit expanded their awareness of digital cultural heritage, particularly regarding the pace of technological development: 'Thanks to the visit, I now know how big the technological leap was over a short time'.

As evident from the study visits, the central theme of private museums housing digital cultural heritage artefacts is mostly video and computer games, arcade games, and/or pinball machines. It is only natural because retrogaming particularly effectively appeals to the imagination of potential visitors, especially young people. However, the interviews show that the respondents were more interested in archaic radio receivers, TVs, telephones, and electronics than in computer games or gaming consoles. The respondents were particularly interested in Polish UNITRA radio receivers, Vela TVs, or the Polish Alfa K2 vacuum cleaner manufactured until the mid-1970s. This is not to say that archaic gaming equipment failed to arouse interest. Quite the contrary, but the observations suggest that it is relatively well-known. Visitors to the museum focused more on objects with which they were less familiar, and that were not as common in popular culture as computers or consoles. It is, in a way, a suggestion for museum curators. Apart from well-known devices like the Atari or Commodore, interactive exhibitions can also display objects and décor typical of the times, including original small everyday objects, such as a desk lamp, floppy disk boxes, or era-specific computer magazines. One such exhibition can be found at the Museum of the History of Computers and IT in Katowice. Opinions of the visitors to the Museum of Electronics in Kraków confirmed that it is reasonable to offer detailed, holistic exhibitions that reflect the spirit of the age.

Owners of private museums displaying digital equipment, including computers, video game consoles, radios, and other electronics, often show no interest in meeting the formal criteria set in the Act necessary to become an 'official museum'. In the words of the owners of the Museum of Electronics in Kraków: 'We do not aspire to become a museum in the strict sense even considering potential state subsidies. It could deprive us of our independence and decision-making capabilities as museum curators and business people. The extensive official supervision over museums in Poland also puts us off.' Their concerns focus on independence: 'We fear we could no longer exercise full control over the exhibition and items we display if we became a state museum.' Therefore, the modest number of digital cultural heritage facilities listed by the ministry could be caused by legal and bureaucratic requirements that the owners believe could restrict their freedom to shape their museum and economic operations. They would rather be 'entrepreneurs involved in the protection of digital cultural heritage' than 'museologists involved in the protection of digital cultural heritage'. In addition, owners of private museums of digital cultural heritage pointed out the debasement of the notion of the museum in the Polish public sphere. They believe it is because many businesses now use the word 'museum' in the name of their commercial operations. The 'cultural heritage' trend is on the rise and used for marketing purposes in this case. Such organisations are generally not involved in conservation, exhibitions, or museum operations. Instead, they focus on profits. Note here that it is a common global malpractice to use the word 'museum' in the name of a commercial venue where visitors can use digital hardware. Only two out of the 33 digital cultural heritage places identified online refrained from using the word 'museum' in their names. This suggests that it is a common approach not frowned upon in the world of retrocomputing and retrogaming.

The curators revealed their plans for business growth during the interview. Their extensive collection of digital hardware, increasing public interest in digital cultural heritage artefacts, especially among pupils, and the untapped market in Silesian voivodeship encouraged them to open a new museum in Chorzów. This means that despite certain difficulties, Poland offers perspectives for the growth of private museums of digital cultural heritage founded on retrogaming and retrocomputing.

5. Discussion

5.1. Digital cultural heritage in local and central government strategies

Digital cultural heritage emerges from technological development, which affects changes in consumer behaviour, market fluctuations, and cultural transformations connected with how people communicate, establish relationships or form communities. Socioeconomic development, in its broadest meaning, should be founded on civilizational achievements and historical knowledge rather than reject them. It is consistent with the notion of harmonious, sustainable development through evolution instead of revolution (United Nations, 1993). Research shows that cultural heritage is gaining more ground and attention in strategic documents. They cover tangible, intangible, and natural heritage extensively, but not digital cultural heritage (Knapik, Król, 2023). Nonetheless, digital cultural heritage should have a chance to appear in regional development strategies just as such 'classical forms of cultural heritage' as religious objects, dishes, handicrafts, and folk traditions and customs (Król et al., 2019). Just like tangible and intangible heritage, digital cultural heritage has museums and devotees who collect, restore, and promote exhibits: hardware and software. It has grassroots initiatives and communities focusing on preserving and promoting cultural heritage. The fast pace of technological development is also a salient factor here because '30 years in the digital ecosystem is like 300 years in construction and architecture'. Rural digital cultural heritage is investigated in Poland as a less-known part of heritage. One of its embodiments is the online promotion of agritourism (Król, Zdonek, 2023).

Digital cultural heritage has a relatively considerable tourist potential for image and brand building and improving regional economic development (Król, 2021). There are many places in Poland and abroad where people strive to preserve and promote the heritage of hardware and software. They provide educational services as well. Consider, for instance, the mission statement of Replay Museum (US): 'Replay Museum promotes the art, science and cultural significance of mechanical amusement machines to preserve these historical artifacts for future generations' (Replay Museum, 2023). Therefore both the institutions and digital cultural

heritage itself should be included in strategic documents. If it is disregarded, posterity can be deprived of a unique piece of history of technology and culture.

5.2.   Perception of digital heritage in Poland

The author noted that digital cultural heritage is mostly associated with computer – or more generally – video games, and 'old computers' in Poland. Therefore, the public should be educated on what digital cultural heritage is. It covers rich and diversified collections of such digital devices as radios but also software and digital files, including websites, digital content, books, audio and video materials, and graphics both born digital and digitalised. Digital heritage encompasses also tools, design techniques, and styles typical of specific periods.

Digital cultural heritage is not just hardware, software, and digital files. It is also socioeconomic events, such as the dot-com bubble, a sudden skyrocketing of stock of new (Internet) technology companies in 2000 and 2001 (Gaither, Chmielewski, 2006). The dot-com bubble burst significantly influenced the society and economy and is still analysed today (DeLong, Magin, 2006). Another prominent example is the digital heritage of radio broadcasting. Broadcast 'The War of the Worlds', based on a novel by Herbert G. Wells, was performed live at The Mercury Theatre on the Air. It was broadcast by an American radio station, Columbia Broadcasting System (CBS), on Sunday, 30 October 1938. Many people believed what they heard on the radio. It was a factoid, a piece of information considered true and accurate only because it is provided by mass media. The 'War of the Worlds' is one of the better-known if slightly exaggerated episodes in the colourful history of mass media. This event demonstrated how mass media can create theatrical illusions and manipulate the public (Hayes, Battles, 2011).

5.3.   (Para-)museums of digital heritage in Poland

Most of the places that store digital cultural heritage artefacts are not museums according to the legal definition (Act, 1996). They are neither in the State Register of Museums nor on the Ministry's list of museums. They, nevertheless, work as if they were museums; they acquire antique hardware, repair it accordingly, run it, and display it for visitors to experience. These people often promote their efforts at special and educational events. The places are run mostly or exclusively by enthusiasts as grassroots projects. The initiatives come from private individuals or associations/foundations. On the one hand, the word 'museum' as used in the Act (1996) in the name of such institution adds gravity, but on the other hand, it often causes controversy, especially among museologists. They point out that entities that 'claim to be museums' are not museums as defined in the Act (1996) and thus are not required to conform to the Act. Therefore, it might be more accurate to refer to these places as 'digital cultural heritage institutions; 'digital cultural heritage entities', or para-museum institutions (institutions related to museums).

The prefix 'para-' derives from Ancient Greek παρά (pará, 'beside; next to, near, from; against, contrary to') and can redefine the word that it precedes either from a temporal, spatial, or causal perspective. According to Nora Sternfeld (2018), a para-museum is a subversive gesture that steals (the power of definition and the infrastructure) from the museum. Regarding digital cultural heritage, the prefix 'para-' describes a new quality created by grassroots activists, enthusiasts, communities of 'nerds', and culture creators in a (para-)museal space.

Formally, and according to the classification by the International Council of Museums (ICOM) recommended by UNESCO, the term 'para-museum institution' covers zoological and botanical gardens, nature reserves, historical monuments as well as other institutions, including planetariums, science and engineering villages and centres, and permanent exhibitions that are not museums but display achievements, discoveries, and trivia from history, archaeology, culture, nature, and engineering. According to Statistics Poland (2023) and the ICOM's definition (2022), para-museum institutions conduct museum-type activities but not under a statute or rules approved by a minister for culture and protection of national heritage. Para-museum is a non-museum, a non-profit organisation, the purpose of which is to provide permanent protection to cultural, scientific, and natural assets. It is considered museal in nature. Para-museum institutions, just like other cultural entities, provide education in the form of educational events, lessons at museums, and workshops, but also competitions, seminars, symposiums, and conferences. They are not as engaged in publishing (Statistics Poland, 2023). 'Para-museums' are also referred to as 'museal institutions'. 'By museal institutions, we mean non-profit establishments, museums, exhibition and interpretation centres which, besides the functions of acquisition, conservation, research, and management of collections that some may carry out, have in common that they are places of education and dissemination dedicated to the arts, history, and the sciences.' (Observatoire de la culture et des communautés du Québec, 2004; Desvallées, Mairesse, 2010).

According to Statistics Poland (2023), the largest number of exhibits and live species were in Małopolskie Voivodeship: 2.7 million (57.4%). In 2022, there were 349 para-museum institutions registered in Poland (19 zoological gardens, 38 botanical gardens, and 292 other institutions), 65.3% of which were public and 34.7% privately owned. Para-museum institutions were visited by 18.6 million people in 2022, including 15.5 million in public places and 3.1 million in private establishments. Hence, their role in the protection of cultural heritage is significant. Furthermore, the data show that para-museums seem to be a natural phenomenon. Today, contributions from local communities, volunteers, collectors, enthusiasts, associations of 'friends of museums', and sponsors to the museum effort grow ever more pronounced. This involvement shifts museums towards more social institutions integrated into a network of family, religious, or educational institutions, as pointed out by Peter van Mensch (1992). This mechanism is evident in the Museum of Engineering and Technology in Kraków, where new family zones are opened to the public from time to time, such as the 'building blocks zone' or 'experimental garden'.

5.4. Temporary exhibitions, grassroots efforts, and university projects

Some digital cultural heritage museums are free of charge static exhibitions. Visitors may not operate the exhibits. Such places require no tickets and provide no interactive experience. This approach is typical of university museums and exhibitions. Some of them are the Institute Virtual Museum of Computers of the Wrocław University of Technology or the IT Museum of the Nicolaus Copernicus University in Toruń. Although usually kept in display cases, the items are sometimes taken out for special occasions to promote science and culture or during thematic events, such as the Science and Art Fest or Researchers' Night. According to data found online (www1), 'the exhibits at the IT Museum of the Nicolaus Copernicus University in Toruń usually date back to 1980-2000. The exhibition includes such items as personal computers, mobile computers, servers and network hardware, printers, copiers, terminals, calculators, components, and computer accessories.'

University exhibitions are most often displayed in display cases in halls of individual departments or institutes. 'History of Computers', for example, has been showing items from the Wrocław University of Technology's Computing Centre in display cases since 2000. It was one of the displays linked to an event promoting science and culture, a Science Fest. Components of ELWRO's ODRA and RIAD are on show in two cases. Consecutive display cases contain storage media, 8-bit computers, such as the Spectrum, Commodore, Atari, Sony, Meritum, Macintosh, IBM, and others, and personal computer components, such storage, processors, disks, or modems. The Institute Virtual Museum of Computers of the Wrocław University of Technology offers an online list of computers and an image gallery (www2).

Many digital cultural heritage museums are grassroots initiatives driven by enthusiasts. A grassroots project to record the history of the Polish Elwro 800 Junior had been active online until recently (discontinued website: elwro800junior.pl; now copies available in the Internet Archive). The Elwro 800 Junior was designed for school laboratories. The Elwro 804 Junior was a home-use personal microcomputer for work, learning, and entertainment (Maćkowiak et al., 2018). After many years, the founders of elwro800junior.pl moved all the content to the 'Polskie komputery' (Polish computers) website (https://polskiekomputery.pl, accessed 10.08.2024). 'Polskie komputery' is based on a private collection of artefacts linked to the history of Polish computer engineering. It was initiated in 2016 by a Polish programmer Marcin Robert Kaźmierczak. The Museum of Games and Computers of the Past, just like many other similar places, was also established by enthusiasts. In this particular case, the founders already had experience with a previous project RetroGralnia.

Apart from stationary exhibitions, museums of digital cultural heritage are often active in digital media and offer education (learning courses, lectures, training), exhibitions, and commemoration projects. It is through such effort that digital cultural heritage can reach a broader audience. For instance, the Community Committee for the Commemoration of Zakłady Elektroniczne Mera-Elwro in Wrocław started a group of activists known as

'Elwrowcy'. One of their achievements is a website at http://elwrowcy.pl (accessed 10.08.2024) with documents, publications, photographs, information, and data on the history of ELWRO accompanied by documents and photographs recording the effort to commemorate ELWRO (the square and obelisk).

5.5. Unsuccessful attempts to preserve digital cultural heritage

Not all efforts to preserve digital cultural heritage are successful. The most common obstacles are hardware, organizational, and financial problems, but also an unwelcoming attitude of culture and cultural heritage experts. Some experts voice contemptuous opinions about private museums of digital cultural heritage, belittling them as 'small commercial establishments that collect old games and gadgets' or 'commercial, private institutions that offer people old computer games and electromechanical game machines under the pretence of a museum'. In contrast, the museums on the trail of digital cultural heritage in Poland are or aspire to be among the largest in Europe. Many of them are unique.

Not all attempts to restore digital cultural heritage artefacts are successful. First, it is not always possible to repair antique hardware, which is often in poor condition to start with. It may turn out to be too expensive to repair damaged arcade games to expect any payback, for example. Second, it may be hard to find a permanent hosting site, as in the case of the Museum of Personal Computers (Muzeum Komputerów Osobistych) in Łódź, for example (as on 10.08.2024). Shortage of original parts and their growing prices do not make things easier, aided by increasing costs of electricity and business operations in Poland. These circumstances often force private museums to seek sponsors or patrons. When problems accumulate, the museum can be shut down or moved online, like the Museum of the History of Processors and IT (Muzeum Historii Procesorów i Informatyki).

Archived pages of the Museum of the History of Processors and IT in the Internet Archive read, 'The Museum of the History of Processors and IT is the virtual image of a private collection held by an enthusiast from Kraków.' But it used to be more than just a virtual collection. Collection items were shown during thematic events, such as the EDU Opole Education Show in 2015 (including a demonstration of a mobile laboratory with a microscope and microprocessors on various production stages). The archived information suggests that the museum was open in 2014 and 2015, and the founders intended to 'move the collection to the real world', which is consistent with the growing number of 'field exhibitions'. The archive further holds an extensive 'catalogue of microprocessors' kept at the museum. The website was last updated on 11 September 2015. The reason for its discontinuation is unknown. Archived copies of the pages can be found in the Internet Archive (www3).

5.6. Digital cultural heritage museums in the world

Digital cultural heritage museums focus on recording the history of computer development, hardware, and software in many countries, such as the US, Germany, Russia, Czechia, United Kingdom, Spain, Croatia, and Austria. Computerspielemuseum in Berlin was established in 1997 and has over 350 various consoles and computer systems. It is a co-founder and member of the European Federation of Game Archives, Museums, and Preservation Projects, as well as a member of ICOM and the German Museums Association. Moreover, to improve the conditions for the collection, indexing, and preservation of computer games, Computerspielemuseum is a regular initiator and partner of scientific projects and is involved in various initiatives and projects that aim to develop strategies for the preservation of digital artefacts. The PEEK&POKE Computer Museum was opened in 2007 as an educational non-profit programme at the initiative of several enthusiasts of retrocomputers. Today, the museum hosts over 1000 global items on about 300 m2. The National Museum of Computing in Bletchley boasts the largest European collection of operational archaic computers, the world's oldest original and operational digital computer (Harwell Dekatron or WITCH), and a reconstructed Colossus. The museum mainly acquires computers and IT systems devised in the United Kingdom. Flippermúzeum – The Budapest Pinball Museum has displayed pinball machines manufactured from the late nineteenth century along with the latest offers since 2013. The International Arcade Museum (IAM) of the Museum of the Game (Pasadena, US) is the world's largest museum of the art, inventions, and history of the videogame, amusement, and coin-operated machine industries. Its coverage includes video games, pinball, slot machines, mechanical and electromechanical arcade games, vending machines, trade stimulators, and all other coin-operated devices. What is important, the IAM provides content and community services related to these machines. It also protects, researches, and disseminates thematic knowledge and cutting-edge educational research. To that end, it has compiled one of the world's leading archives covering the art, entrepreneurs, inventions, and history of the amusement and coin-operated machine industries (IAM, 2023). The Museum of Soviet Arcade Machines in Moscow and Saint-Petersburg (Russia) is a private museum with interactive exhibits. The museum represents the world's largest playable collection of unique arcade games produced in the USSR from the 1970s to the 1990s. As the curators put it, 'arcade machines are a big symbol of the Soviet Era. From the mid-1970s to the 1990s, arcade machines were a primary source of entertainment for the Soviet population. Along with special gaming halls, machines could be found in parks, cinemas, hotels and in young pioneer camps – places for children's vacations during the summer and winter holidays, a widespread phenomenon in socialist countries. By playing arcade machines, we not only entertain ourselves but also look into the past. We can learn how the machines were produced and better understand Soviet industrial design, technology, and engineering achievements' (RU, 2023). The museum holds about 130 machines on nearly 400 m^2.

6. Summary

To the best of the author's knowledge, the list and map with the locations of digital cultural heritage museums in Poland are a comprehensive source of information about – probably – all such institutions in Poland (as on 10.08.2024). The recorded places constitute the 'Tourist Trail of Digital Cultural Heritage in Poland'. The author believes that just like tourists are offered wooden architecture routes, trails of wooden churches, or culinary trails, they should be able to follow a digital cultural heritage trail. The trail should reach beyond museums of games and computers. It should include places where the history of Polish computer design is commemorated, like ELWRO Square in Wrocław. The list and the map are a foundation for future work to build an even more comprehensive list of places on the 'Tourist Trail of Digital Cultural Heritage in Poland'.

Institutions that exhibit digital cultural heritage artefacts but fail or do not intend to meet the formal criteria to be official museums build their brands on retrogaming and interaction with antique hardware. They are usually businesses with business names containing the word 'museum' that collect admission fees from individuals and groups and hold special events or lessons in museums. This approach gives them a certain degree of freedom and independence from statutory requirements for museums under the Act. This does not change the fact that these places carry out functions similar or identical to those of registered museums; they collect artefacts, for example, although they do not always catalogue them or compile scientific documentation. Such places also store assets under conditions to maintain their proper repair and safety, preserve and conserve collections, hold permanent and temporary exhibitions, engage in artistic and cultural activities, share their collections for educational and scientific purposes, and finally provide adequate conditions for tourism and access to the collections and information they hold. All this is also in the interest of the owners because they are entrepreneurs in addition to being enthusiasts. Running a museum of digital cultural heritage with faulty or damaged computer equipment is impossible. Note that the retrogaming community is very discerning and specialised. There is not much room for cutting corners with retrocomputer exhibitions. Therefore, to secure business success, institutions make special efforts to keep the artefacts they offer to visitors operational and diversified, as this affects their image and promotion. Their lives as enterprises depend on the number of tickets sold and held special events.

The primary content of digital cultural heritage museums on the 'Tourist Trail of Digital Cultural Heritage in Poland' is computer games, consoles, game machines, and the act of playing games. Still, not all the audience are interested in retrogaming and retrocomputing. Some are passionate about the history of everyday objects. They would prefer exhibitions in electronics, technology, and engineering museums containing antique consoles and computers, automotive artefacts, household equipment, and industrial machinery.

6.1. Practical implications and future research

The list and map of the museums of digital cultural heritage are the foundation for the 'Tourist Trail of Digital Cultural Heritage in Poland'. The purpose of a tourist trail is to show places that the organizing institution considers unique, worth seeing, and worth preserving for posterity.

The 'Tourist Trail of Digital Cultural Heritage in Poland' concept is founded on linking several dozen unique museums in Poland. The initial version proposed here includes 33 places to see. Many of them focus on retrogaming and retrocomputing, complemented by insights into Polish technical and engineering achievements and associated socioeconomic phenomena. Further work on the trail should be directed towards the identification of places and infrastructure, including buildings and structures, squares and monuments, linked to the history of computerization in Poland. They should also be part of the trail. After the list is complete, it will be necessary to design signs and boards in various languages with short descriptions of the place/object and practical guidelines for tourists. Creating a website and an interactive map of the trail is also advisable.

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