PIOTR WINSKOWSKI*

A HOUSE BENEATH THE CITY

DOM POD MIASTEM

A b s t r a c t

This paper contains an analysis of the specific characteristics of underground spaces inhabited by people, starting from prehistory, as well as the changes in the relationship between living underground and aboveground brought on by the emergence of the industrial city of the 19th and 20th centuries. Against this backdrop, the author discusses architectural measures and details that improve the functional quality of underground space.

Keywords: underground cities, contemporary architecture, M. Wells, MVRDV, A. Aalto, Le Corbusier, S. Holl, N. Foster, O. M. Ungers, R. Rogers

S t r e s z c z e n i e

W artykule zestawiono specyficzne własności przestrzeni podziemnych, w których ludzie mieszkali, począwszy od czasów prehistorycznych oraz zmianę, jaką we wzajemnych relacjach między życiem pod ziemią i nad nią przyniosło miasto przemysłowe XIX i XX wieku. Na tym tle zanalizowano rozwiązania architektoniczne i detale poprawiające jakość funkcjonalną przestrzeni podziemnych.

Słowa kluczowe: miasta podziemne, architektura współczesna, M. Wells, MVDRV, A. Aalto, Le Corbusier, S. Holl, N. Foster, O.M. Ungers, R. Rogers

* Ph.D. Arch. Piotr Winskowski, Institute of Architectural Design, Faculty of Architecture, Cracow University of Technology.

1. UNDERGROUND

For thousands of years, cities have been characterised by higher density than the surrounding areas: in terms of the density of population, people's interests and lifestyles, the opportunities that they pursue and the dangers that they try to avoid, and – last but not least – the houses, with their variety of spatial layouts, construction materials, and forms. One of the obvious ways of dealing with an increasing density on the ground level consists in stacking floors. While upward constructions – all technical difficulties notwithstanding – basically copy the same fundamental principles that apply to the ground floor (in terms of access to natural light and possible use as "permanent residence for people", as defined by the law), constructing downwards puts one in a fundamentally different environment: dark, constricted, and – regardless of its actual size – seemingly oppressive and claustrophobic due the user's awareness of being beneath the ground.

An underground placement of storage facilities, such as the cellars beneath the market square in Opatów (13th–15th centuries) and Sandomierz (14th–15th centuries), as well as the use of underground space for transport purposes (i.e. secret escape passages, tunnels, metro systems, subterranean passages) and trade (shops and services in underground passages and at metro stations) have always been widely accepted; even though there has been some concern about the discomfort of the personnel of the latter. The idea of underground dwellings, however, especially with the "normal" city located aboveground, has always been associated with secrecy, danger, and drama, the infernal connotations being only one of the reasons therefor. Underground interiors also offer potential added value that may be used for creating an artistic effect and drawing on the imagery and the emotions evoked by this peculiar location.

Underground spaces, some of which are used until present day as dwellings, form part of the local heritage of many cultures worldwide, including: Derinkuyu and Kaymakli (their origins date back to the 8th century BC) or Zelva and Uçhisar (10th–11th centuries AD) in Turkish Cappadocia[1]; Petra in Western Jordan (most prosperous in the period from the 2nd century BC to the 1st century AD) and Avdat – another city of the ancient Nabataeans, in the Negev desert in Israel[2]; Vardzia in southern Georgia (12th–13th centuries)[3]; Kandovan (13th century) in northwest Iran[4]; and antique Matmata in Tunisia[5]. A less geographically remote example is the Slovakian village of Brlhovce (17th–19th centuries)[6]. This applies in particular

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[1] *Midasstadt in Phrygien. Eine sagenumwobene Städte in anatolischen Hochland*, eds. D. Berndt, Verlag Philip von Zabern, Mainz am Rhein 2002; M. Tobolczyk, *Narodziny architektury. Wstęp do ontogenezy architektury*, PWN, Warszawa 2000, p. 45–48.

[2] W. Machowski, *Petra*, Ossolineum, Wrocław – Warszawa – Kraków 2007, p. 67, 130.

[3] *Vardzia. Ancient monuments of Georgia. History, architecture, wall painting, applied arts*, ed. G. Gaprindashvili, Aurora Art Publishers, Leningrad 1975.

[4] K. E. Eduljee, *Zoroastrian Heritage*, www.heritageinstitute.com/zoroastrianism/urmia/kandovan_2.htm (online: 3.06.2016).

[5] M. Tobolczyk, *op.cit.*, p. 63–65.

[6] B. Rudofsky, *Architecture without Architects. A Short Introduction to Non-Pedigreed Architecture*, Academy Editions, London 1964 (reprint 1973).

to places with soft rock that allowed drilling, and where people could use solutional caves already formed by underground water[7].

The bigger colonies of underground houses display certain urban qualities. While they are removed from the cultural model of a *polis* – i.e. a work of man, removed from nature, geometrically laid out, with an agora, a forum, or a marketplace as a centre of life in larger societies – they can also be found (and are inhabited until today) on our continent. At the same time, those found in Europe, Asia and America, both ancient and contemporary, all display certain distinctly common features. The proximity of nature leaves a universal imprint that depends more on the hardness of rock and the technologies of drilling available, and less on the cultural and social tradition. As to the latter, high density of population and housing forces increased interaction between people regardless of the latitude, creating an opportunity (or an obligation) for people to co-operate on common projects and allowing at least a part of the population to practise non-agricultural professions, which is a starting point for further urban development.

The aim of this paper is to analyse the abovementioned specific characteristics of houses located beneath the city, i.e. under the surface of the ground. The examples discussed henceforth have been selected for the purpose of demonstrating the variety of underground spatial situations. Lacking a distinctive body visible from the outside, underground buildings become a series of rooms delimited by (windowless) walls. Since all that happens within is a consequence of the conditions imposed by the layout of the outside walls, it is impossible – for instance – to take advantage of a "borrowed view", one that sometimes plays a key role in architecture above ground[8]. At the same time, in some aspects an underground location maintains many strictly urban/metropolitan characteristics: it allows the use (sometimes illegal) of the city infrastructure and, generally speaking, for a variety of functional reasons it is feasible only within the city limits.

2. A CITY BENEATH A CITY: A PLACE OF REFUGE AND OPPRESSION

As time passed and living in buildings constructed aboveground became more widespread, the underground space co-existing with the city of the surface became a field of contrasts, tension, conflict, and escape, thus giving proof of the existence of the dangerous side of living on the surface. One example were the early Christian catacombs. While they served as a place of burial, they were also used for shelter in the times of persecution. On the other hand, prisoners were usually kept in underground dungeons, where humidity, absence of sunlight and ill treatment hastened their end despite not having been formally condemned to death.

This duality of underground space as a place of refuge and abuse reproduces itself in modern times in the form of bomb shelters (also nuclear shelters since the Cold War), spaces provisionally adapted for such shelter (e.g. London Underground tunnels during World War II), and treatment sessions held in underground salt mines, contrasting with the use of mines

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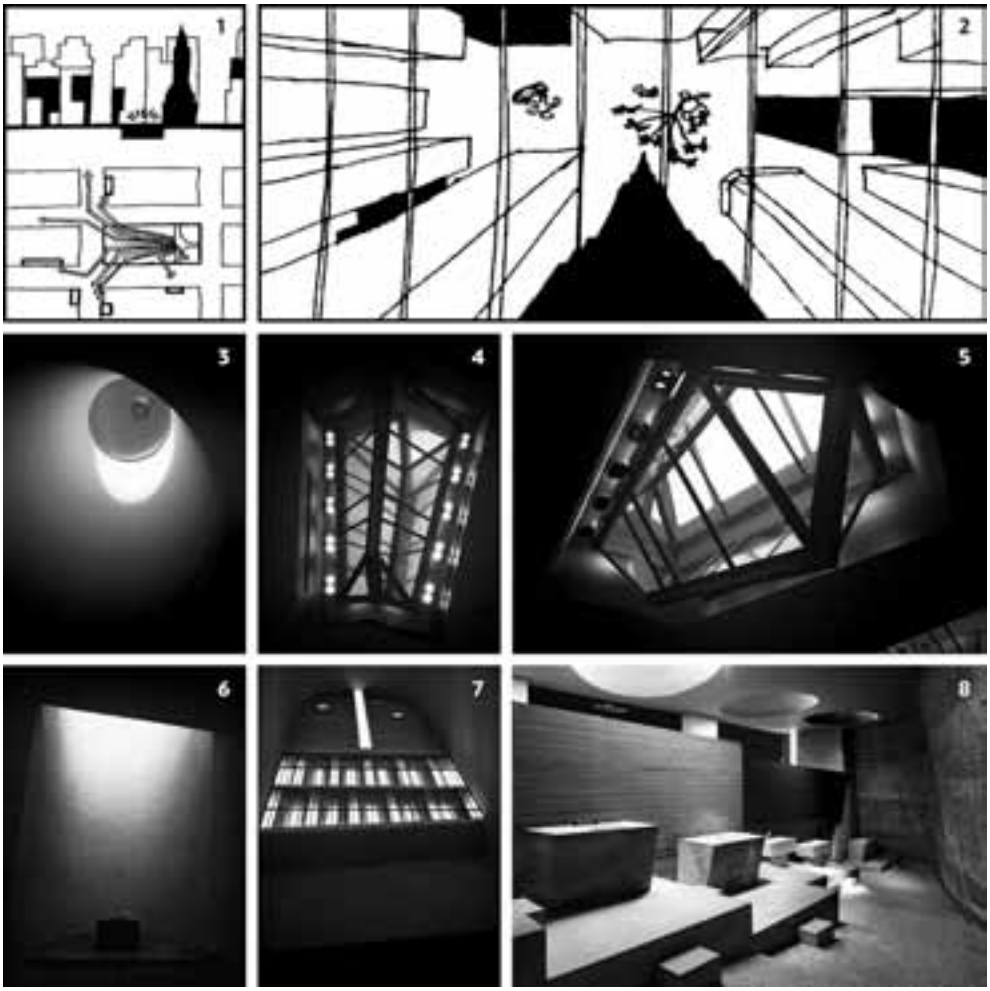
[7] *Skalné obydlia*, www.brlhovce.sk/skalne-obydlia (online: 3.06.2016).

[8] Ch. Alexander, S. Ishikawa, M. Silverstein, M. Jacobson, I. Fiksdahl-King, S. Angel, *A Pattern Language. Towns – Buildings – Construction,* Oxford University Press, New York 1977, p. 642–643.



Ill. 1, 2. William van Alen, Chrysler Building, New York, 1928–1930. MVRDV, conceptual project of the underground square covered with glass and corridors to neighboring skyscrapers, 1995. Section, plan, view looking upwards. Drawings by Piotr Winskowski. Source [26] after [18].

Ill. 3. Alvar Aalto, Main Building of Helsinki University of Technology, Otaniemi, Espoo, 1953–1955, 1964–1967. Skylight with the lamp fixed over the cupola. Photo by Piotr Winskowski.

Ill. 4, 5. Alvar Aalto, Academic Bookstore, Helsinki, 1966–1969. Three layered skylights. Photos by Piotr Winskowski.

Ill. 6. 7. Le Corbusier, Notre Dame chapel, Ronchamp, 1950–1955. Lateral altar in annex-niche. Windows over the altar, on the top of the tower. Photos by Piotr Winskowski.

Ill. 8. Le Corbusier, Sainte Marie de La Tourette monastery, Éveux, 1953–1960. Chapel of lateral altars. Photo Manfred Zimmermann. Source: = (online: 3.06.2016).

as forced labour camps (uranium mining in the Owl Mountains in communist Poland, and before that the *Riese* underground complex built there by the Nazis in 1943–1944), making it easier to contain prisoners and keep secret any information about brutality against inmates.

Nowadays, people who live underground beneath the city on a permanent basis are those marginalised by society: the homeless forced to seek shelter underground due to lack of other available dwellings in big modern cities, who find relatively favourable conditions in abandoned metro tunnels and ventilation shafts (New York), or flood tunnels (Las Vegas, normally dry due to its desert climate). Referred to as *mole people* or *tunnel people*, they fall victim to social exclusion, fall into the clutches of gangs, or willingly join subcultures[9]. These places are not only hidden from the eyes of the police and the aboveground society, but they prove invisible even to researchers who study the subject of social exclusion in general; for instance, they are absent in the typology of slums districts included in the otherwise reliable UN-Habitat report *The Challenge of Slums – Global Report on Human Settlements* (2003), published after the UN conference in Nairobi (2002)[10]. They do fall into general categories in terms of size and location (small and inner-city, or "scattered slum islands"), but they have not been mentioned separately when discussing the "origins and spatial diversity" of slums. However, in order to correctly describe their characteristics and to reasonably compare e.g. the health of their inhabitants or the incidence of specific illnesses, one must consider the fact and the consequences of their underground location.

3. PROPERTIES OF CONTEMPORARY ARCHITECTURE TO BE APPLIED UNDERGROUND

The abovementioned examples refer to the dangerous, dramatic, and sometimes simply sad social circumstances, as well as the properties of underground space where such circumstances take place. An architectural analysis of these properties points towards the deficiencies or factors of oppression that characterise underground spaces, but also the potentially positive features that may be used in designing all types of architecture, not only underground.

This becomes relevant in particular when the difficulties proper to underground buildings occur in those aboveground, especially as a result of misconception, negligence or the deforming impact of the economy on design and construction. This happens when (a) an extreme spatial (visual) and functional separation of floors occurs, regardless of whether they are adjoining or separated by several dozen floors, and (b) the layout and the character of the interiors becomes independent of the outer walls and the windows therein.

These properties, which Rem Koolhaas called respectively "the vertical schism" (when it applies only to load-bearing structure, building installations, closed elevator shafts and emergency staircases) and "the lobotomy" (i.e. the nowadays illegal neurosurgical procedure consisting in severing the connection between the frontal lobes and the hypothalamus in the

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[9] M. Singer (dir.), film *Dark Days*, USA 2000; J. Toth, *The Mole People. Life in the Tunnels Beneath New York City,* Chicago Review Press Inc., Chicago 1993.

[10] A. Miastowska, *Czym jest i gdzie powstaje dzielnica nędzy / Poverty districts/settlements: what they are and where they emerge,* transl. A. Szapert, [in:] *Ku Afryce. Poznawać, działać, dzielić się / Into Africa. Learning, sharing, acting*, Fundacja Razem Pamoja – Książka i Prasa, Warszawa 2014, p. 5–9.

brain, a procedure aimed at "separating the thinking processes from emotions and thus help alleviate the symptoms of a variety of mental illness", which resulted mostly in the loss of the sense of self, loss of the understanding of cause and effect, and complete apathy)[11]. In architecture, these phenomena occur automatically in large size buildings. Koolhaas analysed them on the example of Manhattan skyscrapers, where due to the sheer size and the proportions of the floor plan where workplaces – even in open space offices – are removed by dozens of metres from the walls and the view outside (not to mention the cases when floor space is divided into several smaller rooms, where only those next to the outside walls have a window). Widespread worldwide reproduction of buildings of this kind leads to a situation when it is no longer relevant whether they are constructed above or below the ground.

Obviously, one may also find cases when buildings constructed on the surface offer conditions similar to those underground in traditional architecture; however, most such cases were motivated by other reasons (such as defensive qualities), and they were never as widespread as they are in contemporary architecture. One such example is the Turkish town of Çatal Hüyük (approx. 6300–5700 BC, ruins discovered in Anatolia), where houses were accessed by climbing down a ladder through an opening in the flat roof that together formed the town square[12]. A similar functional arrangement may be found in *pueblo* homes inhabited until today by the Hopi Indian tribe in Taos in the vicinity of Santa Fe (since the 14th century AD) in New Mexico, USA[13].

An underground location could be a factor that such a house is not worse or may even be considered better that one built aboveground. Malcolm Wells (1926–2009), a contemporary American architect, enthusiast and promoter of underground dwelling, designed and constructed houses that took advantage of the terrain conditions: their bodies were often only partially submerged in the ground, with floors at the ground level, and walls and roofs only partially covered by earth. However, the houses that he proposed, even combined into housing complexes, do not acquire an urban character. They are rather a proposition for increasing the standards of individual houses in the suburbs, in the name of both ecology and economy (i.e. energy saving and recovery, using the layer of earth covering the roof as isolation against excessive sun in the summer and cold in the winter, and water heating by rooftop solar power cells). In terms of structure, they do not go beyond the solutions used, for example, in Herbert Jacobs' house in Middleton, Wisconsin (1944–1948) designed by Frank Lloyd Wright. However, the issue of devastation of the earth's surface due to the widespread use of bitumen in the second half of the 20th century is more pressing than it used to be, which made Wells pick up Wright's concept after the latter's death[14].

However, one must note that Malcolm Wells' activity as a publicist and his promotion of the abovementioned ideas drew the attention of a society that consumes immense amounts of the Earth's resources to their responsibility for the depletion, and the potential ways in which such responsibility may be translated into housing technologies. As an author of books and comic books, Wells advertises the buildings of his design not as a hole in the ground that one

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[11] R. Koolhaas, *Deliryczny Nowy Jork. Retroaktywny manifest dla Manhattanu*, transl. D. Żukowski, Karakter, Kraków 2013, p. 114, 120–122.

[12] M. Tobolczyk, *op.cit.*, p. 126–132.

[13] *Ibidem*, p. 150–154.

[14] P. Blake, *Frank Lloyd Wright – architektura i przestrzeń*, transl. J. Mach, WAiF, Warszawa 1990, p. 135–137; *Malcolm Wells*, www.malcolmwells.com (online: 3.06.2016).

must enter through a ladder, or a dark hovel, but as a bungalow shallowly submerged in the earth whose interiors do not differ from standard bungalows equipped with large windows. The windows look out on lush greenery organised within a small space, which makes it possible to increase housing density without abandoning the (not exclusively) American dream of a house on the prairie, or at least in the suburbs.

Wells' achievements notwithstanding, constructions located deeper below the ground and in areas more intensely developed than American suburbs pose more of a challenge. The conditions of fierce competition for space as well as prestige in present-day New York have originated ideas that put Koolhaas' "vertical schism" to extreme use in an attempt to capitalise on another company's brand, logo and architecture. The Dutch group MVRDV's idea (and the 1995 conceptual project) was to excavate an underground atrium in front of the Chrysler Building (1928–1930, designed by William van Alen) covered with glass, thus maintaining the square on the street level. The atrium was to serve as a junction for underground tunnels leading through the basements to the neighbouring skyscrapers, from which one could use elevators to reach offices situated on higher floors. The offices in question, thanks to their connection with the atrium, would therefore acquire the prestigious address reserved to the Chrysler Building (405 Lexington Avenue) despite the fact that they were physically located adjacent buildings[15]. A similar "horizontal-vertical schism" – losing one's way in a maze of passages, then being isolated from the surroundings in the elevator – was already used in the common ground floor of several Rockefeller Centre towers, though this time the purpose was not to sponge on a neighbour's prestigious address: the only things uniting the elements were the common name and the name of the project owner[16].

Designing underground space requires more attention to some details, including – whenever possible – the quality of natural lighting, which seems particularly important. For instance, Alvar Aalto used skylights of original design in many of his (aboveground) buildings[17]. Putting his experiences to use when arranging the lighting of underground space would undoubtedly enhance its functional standard and have a beneficial effect on people who use it (considering the results of research on the impact of sunlight on human wellbeing).

In the projects such as the municipal library in Viipuri (1927–1935), in the Rautatalo office building (1951–1957) in Helsinki, in the University of Technology complex in Otaniemi (1953–1955, construction 1964–1967) in Espoo near Helsinki, and the facilities of the University (Pedagogical School) in Jyväskylä (1953–1959), Aalto used round cylindrical skylights, reaching sufficiently high (around one metre above the roof) so that they remained above the snow that lingers on the roof throughout the winter. On the other hand, the cylinder's height makes it difficult to capture the northern sun when it is low in the sky; however, the slightly inclined position of the cylinder's upper surface, and its shape widening downwards towards the interior, are an efficient way of bringing the captured light to the inside.

The Academic Bookstore building in Helsinki (1966–1969), also designed by Aalto, has three large skylights, each in the shape of an elongated polygon with three layers of glass

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[15] MVRDV, *FARMAX. Excursions on Density*, eds. W. Maas, J. van Rijs, R. Koek, 010 Publishers, Rotterdam 1998, p. 371–381; P. Winskowski, *The Belly and Mind of the Architect,* [in:] *Man within Culture at the Threshold of the 21st Century*, eds. E. Rewers, J. Sójka, Humaniora, Poznań 2001, p. 220–221.

[16] R. Koolhaas, *op.cit.*, p. 225.

[17] P. Winskowski, *Świetliki Alvara Aalta,* Autoportret nr 4 [25] 2008 / 1 [26] 2009, p. 46–53.

each: two (one inside of the other) formed like a high prism directed upwards, and one directed downwards, towards the interior of the hall. A steep, triangle-shaped prism prevents snow accumulation, while air-filled spaces between each of the glass layers ensures relative temperature isolation. The glass panes, none of which is positioned in parallel to another, reflect the light in a way that makes them resemble a crystal chandelier offering a play of many reflections and shadows. A similar, double-layer skylight was also used by Aalto earlier, in the library in the National Pensions Institute building (1948–1956).

Aalto also strove to maintain the impression of natural lighting in the interiors in the long winter afternoons, when it is already dark outside. In the absence of light bulbs emitting light similar to sunlight, not yet invented in Aalto's time, he found another way to obtain a similar effect through architectural means by placing lamps between the panes of a three-layered skylight and mounting them outside, above the cylindrical skylight's glass pane. When artificial light comes from the same places as natural light, and in the absence of other windows in the room, one has the impression that the sun is still shining outside. White plaster and white marble walls reflect the light, multiplying its amount.

Another architect vividly interested in introducing and diffusing light inside buildings was Le Corbusier[18]. He made excellent use of the light coming from above and flooding the interiors devoid of windows – a situation applicable underground – e.g. in the high and narrow lateral towers of the Notre Dame du Haut chapel in Ronchamp (1950–1955). The light floods inside through the windows situated in the upper parts of the towers, invisible to those standing below. Since there are no intermediate floors, the light pours many metres below, reaching the floor, gradually dispersing in the space of the adjacent annex-niche surrounded by a semi-circular white wall covered by rough plaster and serving as a retable for the lateral altars. Since the edge from behind which the light pours coincides with the line separating the main, darker part of the chapel and the brighter adjacent tower, it affirms the structural and functional division of the interior.

Le Corbusier achieved other effects that could be potentially applied in underground architecture through similar means in the Sainte Marie de La Tourette monastery in Éveux (1953–1960). In the ceiling of the low chapel, above the seven massive lateral altars placed one next to another on separate platforms, Le Corbusier placed three round openings – the so-called "light cannons" – that strongly illuminate the surfaces of the altar stones (in particular when they are covered with white tablecloths). Thanks to these openings cut out in the flat ceiling and placing underneath two smaller, straight walls as retables, the light may diffuse only on the surfaces. The chapel as a whole is a vessel full of contrasts: slashed with the sharp edges of the bright insides of "the cannons" and the dark ceiling, the boundaries between the walls, the retable, and the dark corners that provide drama through the contrast between the shade seeping around and the bright enclaves.

The concept of "light cannons" was taken up, between others, by Steven Holl, who used it in many of his designs, such as the Kiasma museum of contemporary art in Helsinki (1992–1998), the Chapel of St. Ignatius in Seattle (1994–1997), or the extension of the Sarphatistraat offices in Amsterdam (1996–2000, inspired by the structure of the Menger sponge). Such a "cannon" piercing the body is particularly effective for a building's function

[18] D. Jędruch, *Zwornik naszego systemu życiowego. Le Corbusier o świetle w architekturze,* Autoportret nr 4 [25] 2008 / 1 [26] 2009, p. 42–45.

and its qualities in terms of design when it passes through not only one or two, but as many as ten floors. This idea was employed by Steven Hool in his Simmons Hall, an undergraduate residence for 350 M.I.T. students in Cambridge, Massachusetts (1999–2002)[19]. The structure, described by the author as "the sponge" (non-Menger) due to its five – sometimes undulating, sometimes bending – diagonal shafts-openings-courtyards-wells, corresponding to staircases, canteens, and common activity areas for students. The placement of these shafts disrupts the regular patterns of rectangular rooms. Although they are topped with roof skylights, on lower floors they sometimes adjoin external walls, where similarly softly shaped windows give them an additional supply of daylight. These windows are the façade equivalent of the disruptions in the floor plan caused by the openings. The rectangular body of the building of nearly 120 metres in length is entirely covered with a grate of several thousand square windows that optically enlarge the building's size since there are three for the height of each floor. The shadows thrown by the façade grate appear on the walls inside the shafts, emphasizing their curvature, while the whole, painted in white, multiplies the reflections of light of different colours and temperatures reaching deep into the building from various directions at once.

Mirrors are, undoubtedly, a solution that amplifies the efficiency of the measures aimed at bringing daylight inside the buildings. They were used for this purpose by e.g. Norman Foster in his thirty-seven floor skyscraper that houses the Hong Kong and Shanghai Banking Corporation in Hong Kong (1979–1986)[20]. The inside is divided into five segments stacked one above the other and separated with maintenance floors, each of the segments comprising five to seven floors with office space. The highest segment receives daylight directly from the windows. The interior of the lowest segment gets light thanks to a mirror mounted on a frame protruding from the façade that directs the light inside to the patio, through a slit at the level of a maintenance floor ("sunscoop"). Under the patio's ceiling, there is another, folding mirror that diffuses the light towards the interior balconies, which are also a place of work additionally illuminated by natural light.

Another, different solution that could be potentially useful for underground indoor spaces is a glass curtain wall made of a one-way mirror. This was used by Oswald Mathias Ungers in his design for the inside patio of the *Johannishaus* (1991–1994, currently Marriott Hotel) in Cologne[21]. The elongated patio that ends in semicircles at both ends is 7 floors deep (around 22 metres), 44 metres long and 12 metres wide. Due to the mirror surface oriented towards the inside of the patio, the opposing walls reflect the sky and one another *ad infinitum*. Therefore, the rooms with windows looking out on the patio have a broader view than those with a view on the street. The unique character of the patio, due to the two parallel walls, is emphasized by the external façades from Johannisstrasse and Am Alten Ufer Street, designed in a way typical of many works by this architect: they are brick walls, with regularly distrib-

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[19] *Steven Holl. Idea and Phenomena*, Architekturzentrum – Lars Müller Publishers, Wien – Baden 2002, p. 66–70.

[20] A. Benedetti, *Norman Foster. Obras y proyectos / Works and Projects*, Editorial Gustavo Gili, Barcelona 1995, p. 146; Ch. Abel, *A Building for the Pacific Century,* [in:] *On Foster … Foster On*, ed. D. Jenkins, Prestel, Munich – London – New York 2000, p. 143; N. Foster, *The Hongkong Bank*, *ibidem*, p. 521.

[21] *Centrum. Jahrbuch Architektur und Stadt 1994*, eds. P. Neitzke, C. Steckeweh, Vieweg, Braunschweig – Wiesbaden 1994, p. 162–165.

uted square windows separated with woodwork into smaller squares. The picture of the patio, photographed looking from the bottom towards the sky, adorns the cover of Martin Kieren's book devoted to Ungers' work[22].

The view from the underground upwards towards the sky is always blinding, hence the widespread use of blinds and screens. When Richard Rogers designed the metro stations of the U5 line in Berlin (1994), which runs relatively close to the surface, he made them into relatively wide ravines covered by all-glass ceilings. "The architects' proposals concentrate on integrating the stations, through a linking sequence of spaces from street to train, into the city's streetscape. (…) The result is an atmosphere of an extension of the street rather than of a disassociated underground world"[23]. Passengers descend from the street to the platform level through balconies located on a middle level; the descent is gradual and ends at a limited depth. The location in line with the lawn, between two street lanes and next to a row of trees, allows one to gaze towards the sky through a natural openwork created by the crowns of trees viewed from below (as long as the skylight is well maintained, autumn leaves are regularly cleaned, and the glass is resistant to the impact of falling branches).

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If the above-described unique architectural details and devices were to find a wider application in design, they would undoubtedly contribute to improving the functionality and the aesthetics of many small and/or underground spaces.

1. A hidden source of light may be perceived as daylight, especially when seen in passing.
2. Diffusing light on a surface that curves in an arc and creates a niche will be perceived as diffusing it in an indefinite space (in a way similar to a semi-circular canvas acting as a horizon on scene), therefore optically expanding the interior. On the contrary, sharp edges between light and shadow define carefully the limits between the components of the interior.
3. Surprising light tunnels, wells or cannons, especially those that converge in one place coming from several directions, increase the visual connection of the site with the surroundings, the more so the smaller the openings and the more massive the walls between the tunnels.
4. Mirrored surfaces have a mysterious capacity of illuminating cramped and dark spaces, and would surely improve many mundane interiors, such as those of the 19th-century townhouses that, with outbuildings, occupy as much as 98% of the parcel they stand on, this being commonplace in Ildefonso Cedra's Barcelona masterplan. The windows, with high parapets, look out on the seven-eight floors deep, tiny, narrow courtyards. There is sufficient protection from excessive sun and heat, but the sense of lack of space is strong, even in the considerably-sized rooms.
5. Dividing any passages descending beneath the ground into more user-friendly sections will improve the users' sense of direction underground.

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[22] M. Kieren, *Oswald Mathias Ungers. Architektur 1951–1994*, Artemis Verlag, Zurich 1994.

[23] *Berlin U5 Bahnhof Line* [in:] *Architecture of Transportation,* Architectural Design Profile no 109, 1994, p. 85.

6. Reception of any visual, artistic solutions applied in the underground space will be weighted down by the users' awareness of being beneath the ground. They may experience the feelings of claustrophobia, an aversion to the ever-present artificial light, or perhaps an unconscious fear of what would happen if it went out. Any chiaroscuro drawings on the wall (or an imitation thereof), any actual or illusory reflections of light coming from some unknown place, any changes in the extent and the height of the interiors, any textures and rhythms in the division of walls – all must deal with those (unpleasant) feelings and impressions in order to influence then, change them, or simply draw attention away from them.

Underground architecture, despite its many drawbacks, is nowadays becoming more and more widespread (mainly for economic reasons), in particular in big cities. The physical realities of such locations make it impossible to entirely avoid such drawbacks. However, careful design may allow one to find new ways of harnessing the experiences already acquired in luxury architecture (where it was an extravagance) or experimental architecture (where the simplicity of its designed purpose often allows the design to be focused solely on the visual effect). It is a professional and moral challenge for the architects to adapt such solutions to buildings that must bear the whole complexity of life, aiming at improving their indoor space, in particular when those are already somehow underprivileged from the start. Once, Ralph Erskine tackled such challenges in relation to residential housing in the remote Northern Sweden and Canada, where for half of the year daylight is lacking even aboveground[24]. Let us take up the challenge in our latitude in relation to underground space, and open a new chapter in history when yesterday's experiments become a norm of tomorrow. As to those who are forced to live in the tunnels, one must hope that they receive effective assistance from homelessness prevention programs.

References

[1] Abel Ch., *A Building for the Pacific Century,* [w:] *On Foster … Foster On*, red. D. Jenkins, Prestel, Munich – London – New York 2000.

[2] Alexander Ch., Ishikawa S., Silverstein M., Jacobson M., Fiksdahl-King I., Angel S., *A Pattern Language. Towns – Buildings – Construction,* Oxford University Press, New York 1977.

[3] Barucki T., *Ralph Erskine,* Arkady, Warszawa 1987.

[4] Benedetti A., *Norman Foster. Obras y proyectos / Works and Projects*, Editorial Gustavo Gili, Barcelona 1995.

[5] *Berlin U5 Bahnhof Line,* [in:] *Architecture of Transportation,* Architectural Design Profile no 109, 1994.

[6] Blake P., *Frank Lloyd Wright – architektura i przestrzeń*, transl. J. Mach, WAiF, Warszawa 1990.

[7] *Centrum. Jahrbuch Architektur und Stadt 1994*, eds. P. Neitzke, C. Steckeweh, Vieweg, Braunschweig – Wiesbaden 1994.

[24] T. Barucki, *Ralph Erskine,* Arkady, Warszawa 1987, p. 26–33; R. Erskine, *Construire dans le nord,* [in:] *Architectures nordiques*, L'Architecture d'Aujourd'hui no 134, octobre-novembre 1967, p. 96–97.

[8] Eduljee K.E., *Zoroastrian Heritage*, www.heritageinstitute.com/zoroastrianism /urmia/ kandovan_2.htm (online: 3.06.2016).
[9] Erskine R., *Construire dans le nord* [in:] *Architectures nordiques*, L'Architecture d'Aujourd'hui no 134, octobre-novembre 1967.
[10] Foster N., *The Hongkong Bank*, [w:] *On Foster … Foster On*, red. D. Jenkins, Prestel, Munich – London – New York 2000.
[11] Jędruch D., *Zwornik naszego systemu życiowego. Le Corbusier o świetle w architekturze,* Autoportret nr 4 [25] 2008 / 1 [26] 2009.
[12] Kieren M., *Oswald Mathias Ungers. Architektur 1951–1994*, Artemis Verlag, Zurich 1994.
[13] Koolhaas R., *Deliryczny Nowy Jork. Retroaktywny manifest dla Manhattanu*, transl. D. Żukowski, Karakter, Kraków 2013.
[14] Machowski W., *Petra*, Ossolineum, Wrocław – Warszawa – Kraków 2007.
[15] *Malcolm Wells*, www.malcolmwells.com (online: 3.06.2016).
[16] Miastowska A., *Czym jest i gdzie powstaje dzielnica nędzy / Poverty districts/settlements: what they are and where they emerge,* transl. A. Szapert, [in:] *Ku Afryce. Poznawać, działać, dzielić się / Into Africa. Learning, sharing, acting*, Fundacja Razem Pamoja – Książka i Prasa, Warszawa 2014.
[17] *Midasstadt in Phrygien. Eine sagenumwobene Städte in anatolischen Hochland*, ed. D. Berndt, Verlag Philip von Zabern, Mainz am Rhein 2002.
[18] MVRDV, *FARMAX. Excursions on Density*, eds. W. Maas, J. van Rijs, R. Koek, 010 Publishers, Rotterdam 1998.
[19] Rudofsky B., *Architecture without Architects. A Short Introduction to Non-Pedigreed Architecture,* Academy Editions, London 1964 (reprint 1973).
[20] Singer M. (dir.), film *Dark Days*, USA 2000.
[21] *Skalné obydlia*, www.brlhovce.sk/skalne-obydlia (online: 3.06.2016).
[22] *Steven Holl. Idea and Phenomena*, Architekturzentrum – Lars Müller Publishers, Wien – Baden 2002.
[23] Tobolczyk M., *Narodziny architektury. Wstęp do ontogenezy architektury*, PWN, Warszawa 2000.
[24] Toth J., *The Mole People. Life in the Tunnels Beneath New York City,* Chicago Review Press Inc., Chicago 1993.
[25] *Vardzia. Ancient monuments of Georgia. History, architecture, wall painting, applied arts*, ed. G. Gaprindashvili, Aurora Art Publishers, Leningrad 1975.
[26] Winskowski P., *The Belly and Mind of the Architect,* [in:] *Man within Culture at the Threshold of the 21st Century*, eds. E. Rewers, J. Sójka, Humaniora, Poznań 2001.
[27] Winskowski P., *Świetliki Alvara Aalta,* Autoportret nr 4 [25] 2008 / 1 [26] 2009.