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Light in Sacred Architecture: Jewish Temples (Synagogues)

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Abstract

The topic "Light in sacred architecture" is very complex and it can be approached, with the same rights and competences, by interpreters of religion, philosophers, all artistic expressions, designers (especially lighting designers) and people of various practical activities.

In this paper, an architect and university professor writes about the topic "Light in sacred architecture", i.e. a person who educates students of architecture in its various fields and a person who designs himself (who has more than ten architectural realizations of sacred buildings).

The paper develops the historical, philosophical, religious, psychological and aesthetic dimensions of the problem of

the presence and use of light in sacred architecture. The intangible and ubiquitous phenomenon of light builds architecture and fills its spaces, appealing to our emotions. Thus, both natural light and artificial lighting serve to get to know special places in the architecture, and then give those places a special character. In the detailed descriptions of architectural objects and the circumstances in which these objects are created, we conclude that light is a co-creator of architectural forms and spaces - from the rudimentary way in which it helps to identify space to the sophisticated ways in which it participates in the creation of a transcendental atmosphere.

Keywords: Light, Sacred Architecture, Judaism, Synagogues

1. Introduction

With his doctoral dissertation ("Defining architectural space on the example of a town house in Yugoslavia", 1988), the author laid the foundations of the theory of Architecturally Defined Space (architecture) and opened countless paths of 'searching for architecture'. He presented his search for architecture through a series of published books - university textbooks, scientific books, monographs and travelogues ^[1].

As the textbooks threatened the curricula of certain subjects, some architectural topics were always left unfinished, that is, some dimensions of architecture were dealt with from the aspect (curriculum) of the specific 'subject' that he taught at the Faculty of Architecture of the University of Sarajevo. For this reason, as an 'extension of the content of university textbooks', he covered certain topics in new books and scientific papers ^[2, 3, 4, 5]. Thus, for example, the university textbook "Architectural Physics" (1996, 2010) experienced its extension through a series of books (university textbooks and scientific books) ^[1]. The same was done with other, fundamental, university textbooks: Constructive systems in architecture ^[1], Architectural constructions VI ^[1], Bioclimatic architecture ^[1], Conceptualization and materialization of the boundaries of Architecturally Defined Space ^[1].

In the university textbook "Architectural Physics", the author dealt with light from a purely physical aspect and the relationship between man and light, determining the 'defining area of human comfort from the aspect of vision conditions': "...Similar to heat and sound, light has its own objective dimensions that define it (wavelength, frequency, energy, various types of behavior when spreading through space...). From the aspect of Architecturally Defined Space (ADS), light is interesting as a tool that enables not only seeing, that is, collecting information from the environment, but also the mechanism of that seeing, as well as the quality of seeing. This means that man is a special system through which the objective dimensions of light are refracted to form an image of reality, along with a series of subjective dimensions of each individual" ^[6] ... "The concept of illumination has, on the one hand, purely physical dimensions by which light is treated as a special form of energy, and on the other hand, those dimensions that express a person's relationship to the world around him. On the physical plane of consideration, light is treated as part of the spectrum of electromagnetic waves, which is determined by a series of physical quantities: speed of propagation, frequency, wavelength, amount of energy, as well as the lawfulness of their propagation through certain environments. On the subjective plane of consideration, light is treated as a means through which a person acquires information about his environment. From the aspect of architectural physics, this second consideration is interesting" ^[6].

2. Light in certain religions

Religion is an organized collection of beliefs, cultural systems, worldviews that connect humanity with the order of existence. Many religions have narratives, symbols and sacred histories that aim to explain the meaning of life or the Universe. From their beliefs about the cosmos and human nature, people derive morals, ethics, religious laws, or preferred lifestyles. Anthropologists used to call religion the 'cultural universe'. No society has ever been able to present something that can be easily recognized by scientists as a religion. According to the philologist Max Muller (1823-1900) [7], "the root of the English word 'religion', the Latin 'religio', was originally used only to honor God or gods, carefully thinking about divine things and piety. A typical dictionary definition of religion refers to "belief in God or the worship of God or gods". Edward Burnett Tylor (1832-1917) defined religion as "faith in a spiritual being" [7]. Anthropologist Clifford Greetz (1926-2006) defined religion as "a system of symbols that operates to establish strong pervasive and long-lasting moods and motivations" [8]. Sociologist David Émile Durkheim (1858-1917), in his basic book *Elementary forms of religious life*, defines religion as "a unified system of beliefs and practices in relation to sacred things" [9].

Nowadays, religion is systematized into primitive religions, animism and supernaturalism, and world religions, theisms and abstract belief systems (Taoism, Buddhism).

2.1 Major world religions

The main world religions are Judaism, Christianity and Islam and Hinduism and Buddhism; the first three are based on holy books, God's word or revelation: Judaism the Torah, Christianity the Gospel, Islam the Qur'an; all three are characterized by faith in one God. The most important sacred texts of Hinduism are the Vedas, which contain the Aryan faith in India; The Vedas include hymns, instructions for rituals, and many reflections on various cosmological topics; The Upanishads are commentaries on the texts of the Vedas that offer a wealth of philosophical speculations about the origin of the Universe, the nature of deities, Atman (the human soul) and the relationship of the human soul to the universal soul (the god Brahman); date from 600 BC; two epics, the Ramayana and the Mahabharata, are also significant for Hindus; most Hindus believe in many gods, but in one fundamental Reality; the soul, after death, is reborn in another body.

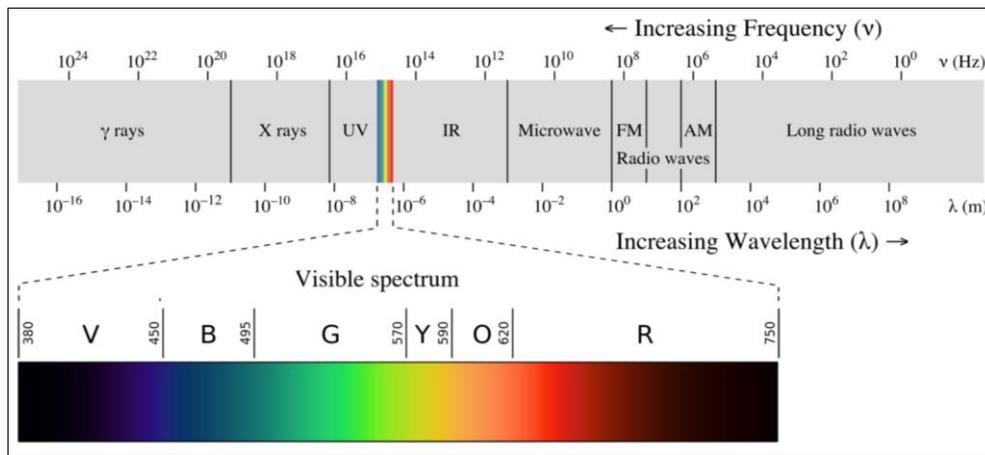
Buddhism is considered a universal teaching that is not determined by the side of the world it comes from; addresses man and what is fundamental in his life and independent of his geographical, ethnic, cultural or social affiliation; it is a teaching that arose out of the Buddha's direct experience of awakening or insight into the true nature of life and is a detailed path leading to it; the four noble truths are one of the fundamental teachings of Buddhism: Dukkha (the experience of suffering and frustration is inevitable in life); Samudaya (experience of

suffering), arises due to misdirected desire, conditioned by ignorance; Nirodha (freedom from confused desire), leads to the end of suffering; Marga (freedom) can be found by following the eightfold path laid out by the Buddha.

3. Light

As a professor of architecture (where, among other things, he teaches the course "Architectural Physics"), the Author teaches about light from the aspect of its 'objective parameters' that make architecture a purposeful space for humans. Similar to heat and sound, light has its objective dimensions that define it (wavelength, frequency, energy, various types of behavior when spreading through space). From the aspect of architecture, light is interesting as a means that enables not only seeing, that is, collecting information from the environment, but also the mechanism of that seeing, as well as the quality of seeing. This means that man is a special system through which the objective dimensions of light are refracted to form an image of reality, along with a series of subjective dimensions of each individual. An architect must know the mechanism of transformation of the objective dimensions of light into a subjective experience, in order to use the results of this transformation in the creation of architecture in a similar way of using building materials, the effects of heating, ventilation and sound systems, for example.

In physics, electromagnetic radiation (EM or EMR) refers to waves (or their quanta, photons) of the electromagnetic field, which spread through the Universe, carrying electromagnetic radiation energy. It includes radio waves, microwaves, infrared, (visible) light, ultraviolet, X-rays and gamma rays. All these waves form part of the electromagnetic spectrum. Classical electromagnetic radiation consists of electromagnetic waves, which are synchronized oscillations of electric and magnetic fields. Electromagnetic radiation or electromagnetic waves are produced due to periodic changes in the electric or magnetic field. Depending on how this periodic change occurs and the power generated, different wavelengths of the electromagnetic spectrum are produced. In a vacuum, electromagnetic waves travel at the speed of light, usually denoted "c" ($c = 300,000 \text{ km/s}$). In homogeneous, isotropic media, the oscillations of the two fields are perpendicular to each other and perpendicular to the direction of propagation of energy and waves, forming a transverse wave. The wavefront of electromagnetic waves emitted from a point source (such as a light bulb) is a sphere. The position of an electromagnetic wave within the electromagnetic spectrum can be characterized either by its frequency of oscillation or by its wavelength. Electromagnetic waves of different frequencies are called by different names, because they have different sources and effects on matter. In order of increasing frequency and decreasing wavelength, these are: radio waves, microwave ovens, infrared radiation, visible light, ultraviolet radiation, X-rays and gamma rays (Fig 1).



<https://www.lumitex.com/blog/visible-light-spectrum>, Accessed: 7.6.2022.

Fig 1: Electromagnetic spectrum with prominent visible light

The language of light is cross-cultural. More than being used as a way to create a place for enjoyment, light in any religion is a special symbol of divinity. Light in holy places creates a contemplative atmosphere for religious meetings. Whether it's churches, mosques, synagogues or temples, accented light helps focus attention on important things. Until the nineteenth century - the eve of the invention of the light bulb - lighting methods remained more or less unchanged from the earliest antiquity. There were three forms of lighting, ordered by their appearance: torches, lamps, and candles, which used animal fat or, in the case of lamps in the most advanced ancient societies, vegetable oil.

3.1 Light in Judaism

” Even in darkness light dawns for the upright, for those who are gracious and compassionate and righteous” (Psalam 112: 4) ^[10].

Light in the Old Testament (Torah):

Genesis Chapter 1 בְּרֵאשִׁית ^[11]

1. In the beginning God created the heaven and the earth (א בְּרֵאשִׁית, בָּרָא אֱלֹהִים, אֶת הַשָּׁמַיִם, וְאֶת הָאָרֶץ)
2. Now the earth was unformed and void, and darkness was upon the face of the deep; and the spirit of God hovered over the face of the waters (וְהָאָרֶץ, הַיִּתְהָה תְּהוֹ ; וְרוּחַ אֱלֹהִים, מְרֻחָה עַל-פְּנֵי הַמַּיִם (וְבוֹהוּ, וְחֹשֶׁךְ, עַל-פְּנֵי תְהוֹם; וַיְרוּחַ אֱלֹהִים, מְרֻחָה עַל-פְּנֵי הַמַּיִם)
3. And God said: 'Let there be light.' And there was light (וַיֹּאמֶר אֱלֹהִים, יְהִי אוֹר; וַיְהִי-אוֹר)
4. And God saw the light, that it was good; and God divided the light from the darkness (וַיַּרְא אֱלֹהִים אֶת-הָאוֹר, כִּי-טוֹב; וַיַּבְדֵּל אֱלֹהִים, בֵּין הָאוֹר וּבֵין הַחֹשֶׁךְ)
5. And God called the light Day, and the darkness He called Night. And there was evening and there was morning, one day (וַיִּקְרָא אֱלֹהִים לְאוֹר יוֹם, וְלַחֹשֶׁךְ קִרְיָה ; וַיְהִי-עֶרֶב וַיְהִי-בֹקֶר, יוֹם אֶחָד)

Ein Sof or Eyn Sof (Hebrew: אין סוף), in Kabbalah, is understood as God prior to any self-manifestation in the creation of any spiritual realm, probably derived from Solomon ibn Gabirol (c. 1021), the term 'Endless' (she-en lo tiklah). It was first used by Azriel (c. 1160 - c. 1238), who, sharing the Neoplatonic belief that God could have no desire, thought, word, or action, emphasized the negation of any attribute. From Ein Sof, nothing can be understood ('Ein') (limitation of 'Sof'). It is the origin of the Ohr Ein Sof, the 'Infinite Light' of paradoxical divine self-knowledge, annulled within the Ein Sof before creation. In the Lurianic

Kabbalah, it is from there that the first act of creation takes place, the Tzimtzum's self-withdrawal of God to create 'empty space'. In Hasidic Judaism, Tzimtzum is only an apparent concealment of Oh Ein Sof, which gives rise to monistic panentheism. Consequently, Hasidism focuses on the divine essence of Atzmus, rooted more in divinity than Ein Sof, which is limited to infinity and which is reflected in the essence (etzem) of the Torah and the soul.

According to Gersh Scholem (1897-1982) ^[12, 13], Ein Sof is the emanator of the ten sefirot. The Sephiroth are radiations of energy found on the Kabbalistic Tree of Life. The Ein Sof, Atik Yomin ('Ancient Day'), emits the sefirot into the cosmic womb of Ayin in a way that results in the created Universe. The three letters that make up the word 'Ayin' (אין) denote the first three purely intellectual Sephiroth, which precede any emotion or action. The order of devolution can be described as:

- 000. Ayin (Nothing; אין)
- 00. Ein Sof (Limitlessness; אין סוף)
- 0. Ohr Ein Sof (Endless Light; אור אין סוף)
- Tzimtzum (Contraction; צמצום)
 1. Keter (Crown; כתר)
 2. Chokhmah (Wisdom; חכמה)
 3. Binah (Understanding; בינה)
 4. Chesed or Gedulah (Loving Kindness or Mercy; חסד)
 5. Gevurah or Din (Power or Judgement; גבורה)
 6. Tiferet (Beauty or Compassion; תפארת)
 7. Netzach (Triumph or Endurance; נצח)
 8. Hod (Majesty or Splendor; הוד)
 9. Yesod (Foundation; יסוד)
 10. Malkuth (Realm; מלכות)

The Sefirot consist of light invested in vessels, similar to water poured into a glass. As it takes the shape of the glass, the water is essentially unchanged. Concerned that a misinterpretation might lead to an idolatrous belief in the duality or multiplicity of God, Kabbalists often point out that the sefirot are bound up in the Ein Sof and that without the Ein Sof the sefirot do not exist. However, there is an apparent contradiction, for in the Kabbalah the Sephiroth are sometimes called divine, despite the claim that they are merely vehicles for the manifestation of God. Moses ben Jacob Cordovero, who gave the first complete systematization of Kabbalah in the 16th century, resolved the contradiction, explaining that the sefirot consisted of lights invested in vessels. In particular, while the vessels are different means of creation, the light is the undifferentiated

light of Ein Sof. This is similar to the way water poured into vessels of different shapes will take on the shapes of the vessels, or how light streaming through different colors of glass appears in different colors. Despite the change in appearance, water and light emanate from the same source and are fundamentally unchanged; the vessels only serve to filter and obscure the light to reveal the various aspects of the creator and allow the creations to benefit from his light. This explanation was accepted and expanded in later works of Kabbalah and Hasidic philosophy.

One indication of the importance of light in Judaism is the number of Hebrew words that mean or refer to light. The simplest word, 'ohr', is used in the creation story. Uses of ohr in the Torah include 'yotzeir ohr' (creator of light), 'me'orot' (lights of the Sun and Moon) and 'orah v'simcha' (light and joy, from the Book of Esther). Ohr is also sometimes used as a synonym for joy.

'Aish' means 'fire' but can mean 'light' or 'flame'. Aish is used in expressions like 'flame of romance' and 'flame of memory'.

The Hebrew adjective, 'baheir', technically means 'brightness', but it can also be used to describe a person with a radiant or sunny disposition.

The root word 'bezek' forms a verb meaning 'to flash' or 'to emit a bright light'. (The Israeli telephone company is called 'Bezek').

'Ziv' (rhymes with 'allow') means 'shine'. In the Midrash there is a picture of the 'world to come' in which the righteous will no longer have to eat, drink or fulfill other physical needs, but will sit and bask in the 'ziv shechini' - 'the radiance of God's presence'. Another story of the Midrash describes Moses coming down from Mount Sinai with the Ten Commandments with 'ziv panim' - 'shine in his face'.

The menorah dates back to the second century AD. In Hebrew, the word 'menorah' means 'lamp' (Fig 2). The ancient menorah had seven branches - one for each day of Creation - and burned in the Temple in what was then Judea, a small area caught in the middle of the conflict between the Egyptian Empire and the Greco-Assyrian Empire.



<https://home.dartmouth.edu/news/2019/12/menorah-symbol-light>, Accessed: 7.25.2021.

Fig 2: The menorah on Zeleni signals the beginning of Hanukkah

It was an eternal light, an oil lamp that was never to be extinguished. These two empires clashed in 167 BC, and under the ruler Antiochus IV Epiphanes (215-164 BC), Judea became Hellenized. Antiochus banned Judaism. The Jewish people were told they could not keep the Sabbath, they could not keep kosher, and the Temple was desecrated. A small group of people rebelled and became known as the Maccabees. Over the course of several years, they managed to restore the Temple and light the menorah. It is said that one day's oil miraculously lasted for eight days. That is why the menorah in Hanukkah has nine candles: one for each of the eight days and one to light the rest. The Hanukkah menorah is more accurately called a hanukkiyah. One additional wick or oil candle is lit each night to celebrate the eight days of Hanukkah. By the way, oil also finds its way into Hanukkah foods like latkes - potato pancakes fried in oil - and delicious jelly-filled doughnuts, called 'sufganiyot'. Hanukkah means dedication. Historically, Hanukkah marks the rededication of the sanctuary itself. The story of the oil and how it lasted for eight days originated later in Jewish

tradition. And most likely it was an attempt by the rabbis to take a story that began as a military saga and shift the emphasis to the importance of religious freedom, hope and light.

Hanukkah is a minor holiday in the Jewish calendar, but it has a growing significance. One way to look at it, even if you're not Jewish, is that it celebrates the wonder of people caring for each other and doing what's right. In a traditional Hanukkah, the candles that represent each day are no bigger than each other. In a world of division, we have rituals that remind us that there is danger when we elevate one group over another, and there is hope and beauty when we connect with each other as equals^[14].

The Flammarion engraving is a woodcut by an unknown artist, so named because its first documented appearance is in Camille Flammarion's (1842-1925) 1888 book *L'atmosphère: météorologie populaire* (Atmosphere: popular meteorology)^[15]. Wood engraving is often, but incorrectly, called woodcut. It was used as a metaphorical illustration of either scientific or mystical quests for knowledge (Fig 3).



https://hr.wikipedia.org/wiki/Biblijski_izvje%C5%A1taj_o_stvaranju#/media/Datoteka:Flammarion_Woodcut_1888_Color_2.jpg, Accessed: 7.25.2021.

Fig 3: Flammarion's engraving shows how the ancient Hebrews imagined the world

The print shows a man dressed in a long robe and carrying a staff at the edge of the Earth, where it meets the sky. He kneels and passes his head, shoulders, and right hand through the starry sky, revealing a wondrous realm of circular clouds, fire, and the Sun beyond the heavens. One of the elements of cosmic mechanization strongly resembles the traditional pictorial representations of the "wheel in the middle of the wheel" described in the visions of the Hebrew prophet Ezekiel. The inscription accompanying the engraving in Flammarion's book reads:

"A medieval missionary says that he found the point where heaven and earth touch" ^[15]. Astronomer Ernst Zinner claimed in 1957 that the painting dated from the German Renaissance, but he was unable to find any version published before 1906. Further investigation, however, revealed that the work was composed of images characteristic of different historical periods and that it was made with a burin, a wood engraving tool, only from the end of the 18th century. The image was found in Flammarion's book by Arthur Beer (1900-1980), an astrophysicist and historian of German science from Cambridge, and independently by Bruno Weber, curator of rare books in the central library in Zurich.

4. Jewish temples

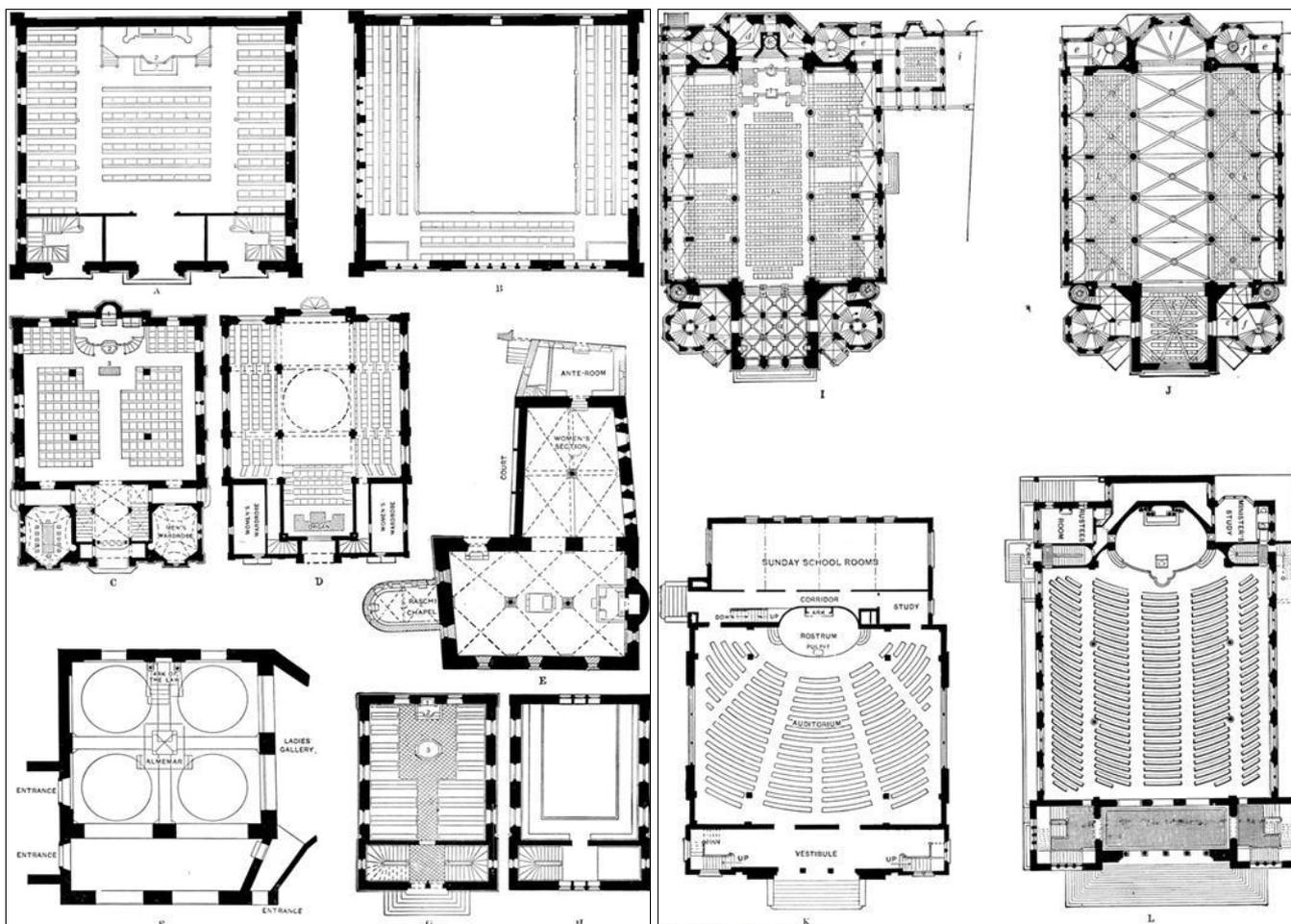
Synagogue (Ancient Greek: συναγωγή - synagogē = assembly, Hebrew: בית קנסת - beit kneset = assembly house or בית פפילה - beit tfila = house of prayer, Yiddish: שול - shul, Ladino: אשנוגה - esnoga = shining like fire) is Jewish or rarely Samaritan house of worship. Synagogues have a place for prayer (the main sanctuary), and may also have study rooms, a social hall, and offices. Some have a separate room for Torah study, called בית מדרש - beth midrash = lighted, house of study. Synagogues are sacred spaces used for

prayer, reading of the Tanakh (the entire Hebrew Bible, including the Torah), study and gathering. However, a synagogue is not required for Jewish worship. Halakha holds that communal Jewish worship can be performed wherever ten Jews gather (minyan). Worship can be done alone or with less than ten people gathered. However, the halakha considers certain prayers to be communal, and therefore can only be recited by a minyan. Given its special ritual and liturgical functions, the synagogue does not replace the long-destroyed temple in Jerusalem.

Synagogues in the sense of purpose-built places of worship or rooms originally built for some other purpose but reserved for formal, communal prayer, however, existed long before the destruction of the Second Temple. The earliest archaeological evidence of very early synagogues comes from Egypt, where stone synagogue dedication inscriptions from the 3rd century BC prove that synagogues existed by that date. More than a dozen Jewish (and possibly Samaritan) Synagogues from the Second Temple period have been identified by archaeologists in Israel and other countries belonging to the Hellenistic world. Any Jew or group of Jews can build a synagogue. Synagogues were built by ancient Jewish kings, wealthy patrons, as part of a wide range of human institutions, including secular educational institutions, governments and hotels, by the entire community of Jews living in a particular place or by subgroups of Jews arranged by occupation, ethnicity (Sephardic, Polish or Persian Jews in the city), the style of religious ceremony (Reform or Orthodox synagogue) or according to the followers of a certain rabbi. It has been theorized that the synagogue became the place of worship in the region after the destruction of the Second Temple during the First Jewish-Roman War. The popularization of prayer over sacrifice in the years before the destruction of the

Second Temple in AD 70 prepared Jews for life in the Diaspora, where prayer would serve as the center of Jewish worship. For Jews living after the revolt, the synagogue functioned as a portable system of worship. Inside the

synagogue, Jews worshiped through prayer rather than sacrifice, which had previously served as the main form of worship in the Second Temple.



<https://www.pinterest.com/pin/508554982903901610/>, <https://www.pinterest.com/pin/synagogue-architecture--508554982903901546/>
 Accessed: 7.8.2022.

Fig 4: Plans of some famous synagogues in the world: A and B Landsberg (plan and gallery), C and D Göppingen (plan and gallery), E Crvi (plan), F Nikolsburg (plan), G and H Heidenheim (plan and gallery), I and J Munich (plan and gallery), K Indianapolis (plan), L Beth-El, New York (plan)

In 1995, Howard Lee Clark argued that synagogues were not a developed feature of Jewish life before the Roman-Jewish War of 70 CE. Lee interpreted his findings as evidence that references to synagogues in the New Testament, including Jesus' visits to synagogues in various Jewish settlements in Israel, are anachronistic. However, as of 2018, Mordechai Aviam reported that at least nine synagogues known to pre-date the destruction of the Jerusalem Temple in 70 have now been excavated, including Magdala, Gamla, Masada, Herodium, Modi'in (Kh. Umm el - 'Umdan), Qiryat Sepher (Kh. Bad 'Issa) and Kh. Diab. Aviam concluded that he thought that almost every Jewish settlement at that time, whether it was a polis or a village, had a synagogue¹.

According to legend, the El Ghriba Synagogue in Djerba, Tunisia was first built in 586 BC or 70 BC, which would make it the oldest synagogue still standing and in continuous use in the world. Among the oldest buildings built as synagogues are the Old Synagogue in Erfurt, Germany, which was built around 1100, and the Santa María la Blanca Synagogue in Toledo, Spain, which was built in 1190. However, neither has been used as a synagogue for centuries. The oldest active synagogue in the world is the Prague Old Synagogue in the Czech Republic, built in the 1270s. The Ben Ezra Synagogue in Cairo is the longest-lived synagogue in the world, serving continuously

¹ The oldest evidence of the presence of synagogue buildings is found in Middle and Lower Egypt in the 3rd century BC on Elephantine Island. They consist of two inscriptions dedicating the synagogue and referring to the synagogue in a papyrus letter dated 218 BC. The oldest synagogue building discovered by archaeologists is the

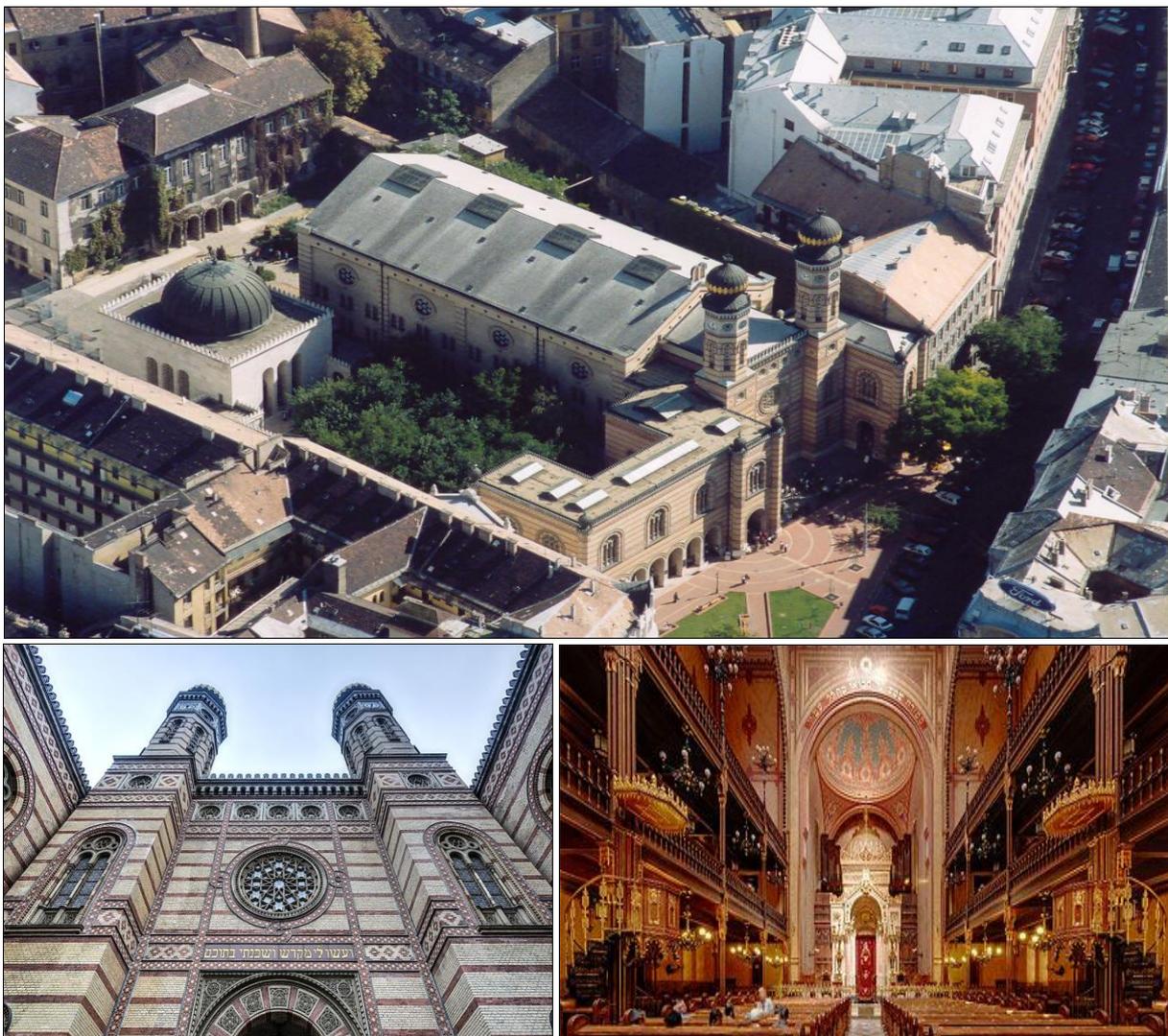
Delos Synagogue, possibly a Samaritan synagogue dating from 150 to 128 BC or earlier, located on the island of Delos in Greece.

from 1025 until the middle of the 20th century. Thanks to the migration of almost all Egyptian Jews to Israel, today the synagogue functions as a museum.

Below we present some of the largest synagogues in the world. They seem to share a common historical trend of survival in relation to the historical chances that threatened their existence (Fig 4). Such challenges include Judeophobia, wars, intra-religious conflicts and other political processes. These synagogues also act as important centers for the preservation of endangered Jewish literature and cultural heritage, as well as a place where Jews, spread throughout the world, meet and worship. In all these challenges, the continued resilience and commitment of the global Jewish communities has proven to be their greatest asset. Although synagogues existed long before the destruction of the Second Temple in AD 70, communal worship while the Temple was still standing focused mainly on the korbanot (sacrificial offerings) brought to the Temple in Jerusalem by the Kohanim (priests). The all-day Yom Kippur service, in fact, was an event in which the congregation observed the movement of the kohen gadol (high priest) as he offered the daily sacrifices and prayed for his success. According to Jewish tradition, the people of the Great Assembly (circa 5th century BC) formalized and

standardized the language of Jewish prayers. Before that, people prayed as they saw fit, each individual prayed in his own way, and there were no standard prayers that were said. Johanan ben Zakai, one of the leaders at the end of the Second Temple, announced the idea of creating individual places of worship in any place where the Jews found themselves. This contributed to the continuity of the Jewish people by maintaining a unique identity and a portable way of worship despite the destruction of the Temple.

The Dohany Street Synagogue, which is the largest in Europe, is the center of Neo-Jewish Judaism with a capacity of 3,000 people. Built from 1854 to 1859 in Budapest, Hungary (Fig 5). The synagogue decorations resemble North African Islamic art with elements of medieval Spanish art. This synagogue has a complex that includes the Temple of Heroes, a cemetery, a memorial area, the Jewish Museum and the synagogue itself. The synagogue has three aisles, two balconies, an organ and an ark containing scrolls from synagogues that were demolished by Nazi rule and the Holocaust. After Hungary returned to democracy in the 1990s, renovations began and Jews from all over the world sent donations. However, this synagogue has faced several anti-Semitic attacks that are suspected to be politically motivated.



https://commons.wikimedia.org/wiki/File:Synagogue_-_Budapest.jpg

<https://www.worldatlas.com/articles/the-largest-synagogues-in-the-world.html>

<https://www.hvweb.net/en/360photos/budapest/great-synagogue/>, Accessed: 7.17.2021.

Fig 5: Great Synagogue in Budapest

Tempio Maggiore is also known as the Great Synagogue in Florence (Fig 6). It was a historically important element of Jewish life in Tuscany after emancipation in the 19th century. The synagogue was built (1882) in memory of the newly discovered religious freedom. The design was a synthesis of Italian architectural tradition and Moorish style elements. The building is constructed from layers of tufa

and granite, creating a bold pattern of red and beige stripes that have since faded. During the Second World War, the Nazis and the Italian fascists tried to carry out a plan to destroy the synagogue with explosives. Italian resistance fighters thwarted this plan by removing most of the bombs. The Jewish community in the areas surrounding the temple dates back to Roman times.



https://en.wikipedia.org/wiki/Great_Synagogue_of_Florence, <https://www.jewishflorence.it/sinagoga/> Accessed: 7.31.2021.

Fig 6: Tempio Maggiore/Great Synagogue, Florence, Italy

The New Synagogue in Szeged, Hungary, was designed in the Hungarian style, a combination of Art Nouveau, historicism and Moorish aesthetics (Fig 7). There are even some Gothic and Roman architectural details present in the structure. The synagogue was designed by the architect

Lipót Baumhorn (1860-1932), known for his fin de siècle style. The synagogue belonged to a large Hungarian Neological Jewish community. The Ark of the Torah is made of Sittim wood, a biblical reference to Solomon's Temple.



https://commons.wikimedia.org/wiki/File:Szeged,_Zsinag%C3%B3ga_-_1%C3%A9gi_fot%C3%B3.jpg
<https://nl.pinterest.com/pin/190769734199381340/>, Accessed: 7.31.2021.

Fig 7: New Synagogue, Szeged, Hungary



Source: <https://travel.sygi.com/en/poi/ashkenazi-synagogue-poi:5889604>, <https://sarajevo.travel/ba/sta-raditi/askenaska-sinagoga/137>
 Accessed: 11.10.2022.

Fig 8: Ashkenazi Synagogue in Sarajevo (1902)

The Ashkenazi synagogue in Sarajevo² (Fig 8) was built in 1902 according to the project of the architect Karel Pařík (1857-1942). At that time, it was the third largest synagogue in Europe. The construction works were managed by Ludwig Jungwirth (1868-1943), while the interior decoration and painting was done by Ludwig Oisner. The building was renovated in 1933. With the reconstruction that was done in the period 1964-1965, the building was divided in height, whereby the upper part retained the function of the temple, while the ground part is used for various social activities.

5. Artificial lighting in sacral architecture

Lighting (or lighting) describes the way the human eye (man) is exposed to natural or artificial light. Natural light comes from the Sun, stars or fire. The intensity of these sources will depend on the time of day and location. Buildings are often designed to optimize the capture of natural daylight. In contrast, artificial light is man-made and can come from sources including fire, candlelight, gaslight,

electric lamps... Today, the term 'artificial lighting' generally refers to lighting generated by electric lamps. The term 'lamp' refers specifically to a light source, which typically consists of a light element housed in an external container (bulb or tube) that emits radiation within the visible spectrum. Artificial light, in general, is easily manipulated to achieve the desired lighting result. Light can be increased or decreased, directed, focused and colored. This allows the lighting to create a series of effects according to the requirements of the space [6]. In recent years, there has been a major shift from traditional incandescent bulbs to energy-efficient alternatives.

Incandescent lamps. A traditional light bulb with an incandescent bulb, which was once often used in residential buildings. They are generally considered to be the least energy efficient choice of electric lights, but they are cheap, turn on instantly and come in a variety of sizes and shapes.

Fluorescent lamps. Compact Fluorescent Lights (CFL) are available in a variety of sizes and fixtures and can be used in place of incandescent bulbs without changing fixtures. They are generally more energy efficient than incandescent bulbs. Some are dimmable and compatible with other lighting controls. CFLs come in rod, spiral and reflector varieties.

Light Emitting Diode (LED). LEDs are a rapidly developing lighting technology and are one of the most energy efficient lamps available. Compared to incandescent bulbs, they can use about 75% less energy and can last 25 times longer, but

² The Commission for the Preservation of National Monuments of Bosnia and Herzegovina adopted decision no. 07.1-2-126/06-4 of July 6, 2006, (Official Gazette of Bosnia and Herzegovina, number 53/08) declaring the Historical Monument - Ashkenazi Temple in Sarajevo a national monument of Bosnia and Herzegovina.

they are much more expensive. They are generally highly valued for their comparable or higher quality light output compared to other types of lighting.

5.1 Types of artificial lighting

Ambient lighting. This is general artificial lighting and overall lighting in the room. It can provide an even spread of light to give most people a comfortable level of illumination and to be able to see reasonably well and move around the room safely. It can usually be delivered using pendants (on walls) or ceiling lights.

Task lighting. This light enables the execution of tasks such as reading, studying, working on production machines, working on the production line... It is used where the level of light in the environment is insufficient to perform tasks.

Accent lighting. This type of lighting adds drama and character and allows you to highlight certain features that are considered interesting. The idea is to draw the viewer's attention to an illuminated 'point', on a wall, a decorative pool, an expensive vase - for example.

The necessity, justification, quality and type of artificial lighting are very important and current in contemporary sacred buildings. True, most of them use natural light as a tool of artistic highlighting or even as a work of art in itself that unites the regular sphere and visibility. Therefore, the interior does not require artificial light from outside, only functional and temporary lighting. On the other hand, another group of modern churches and sacred buildings generally uses artificial light already in the design phase as part of art or as a tool for highlighting. Sacred buildings use artificial light not only as an artistic tool, but also as an indispensable instrument for highlighting the architectural form, the lack of which would make the interior space insignificant or even frightening. In the second group, artificially lit sacred objects, the color and intensity of the artificial light were chosen to emphasize the architectural design, and through this at the same time display artistic and decorative elements that have a functional role. Such portholes are generally arranged in or around the direction in which natural light enters and their design closely follows the atmosphere of the interior of the sacred space. Their arrangement often follows the rhythm of doors and windows and the shape of individual structural elements of the building. Special attention should be paid to the fact that artificial light has an impact on our sense of time. The cyclical nature of time, the power of regeneration, can best be expressed consciously and artistically represented by the appropriate, dynamic use of natural light, while the subjective feeling of time can be characterized by the use of static artificial lighting.

5.2 Methods of lighting historical sacred buildings

The internal and external application of light in sacred buildings can have several interpretations. We are talking about the indirect use of light (whether it is natural or artificial light) which serves to emphasize an emphasized element of the interior (sculpture, painting, a certain area...). The dimensions and arrangement of transparent panels with the aim of encouraging meditation and introversion are another example of the indirect use of lighting. Examples of direct use can primarily be found in communities that worship light or the Sun. There we find an extremely wide range of lighting techniques that use the annual shift in the direction of daylight intensity as well as the daily cycle of

changing lighting conditions from sunrise to sunset. As a result of the further development or extinction of such cults, the latter type of sacred buildings no longer strike their modern viewers with awe of the ancient deities, but often evoke respect only for the advanced state of natural sciences in such ancient communities of our ancestors. In the early days when Christian congregations were housed in houses, which were later converted into churches by enlarging the interior, the size and arrangement of transparencies (windows) were apparently the same as for other residential buildings. The typical early Christian 'catacomb atmosphere' left its mark on sacred buildings centuries later. The vaulted cave-like space, which was dimly lit but in some places brightly lit (later an artistic tool for emphasis), had the psychological effect of a cave or similar structure that serves to protect the primal instincts of people.

Generally speaking, the Ravenna school was the first to deal with the lighting of the building structure, the arrangement of doors and windows and decorations in a perfectly balanced and harmonious way. The light enters inside, in parts concentrated in certain directions, thus creating a dim and vague air full of character. The atmosphere of the interior is further enhanced by the colors and patterns and resembles the lights of the night. Although the technical and artistic methods still resemble the architecture of the catacomb era (Christ on his throne above the entrance, depicted as the good shepherd and the mosaic on the vaults showing a representation of the starry sky, with respect for the plasticity of the surfaces, a nocturnal version of that era's view of the Universe), but the quality and the nature of the decorative elements signal, already on these early buildings, the birth of a new school. It was in the golden age of Ravenna - in accordance with early Christian and Roman paintings - that full figures and rings of their heads, as the first appearance of glory, were presented. The symbolism of glory serves well to illuminate the characteristics of the interior of the sacred building: the originally sharp contrast between light and shadow has evolved over time into an even illumination almost devoid of contrast. The use of a large number of small windows, especially small in comparison to the bulk of the building, was an innovation first seen in the purely Byzantine style of architecture. The arrangement of the windows was independent of the cardinal directions and generally followed a circular pattern or one with at least two axes of symmetry. Structural knowledge of the late and mature Roman period would have made it easier to install more openings in the walls for lighting. The fact that this was not the case is mainly attributed to the impossibility of heating the huge sacred spaces, the rare use of glazing and the function of the church building as a stronghold.

Gothic architecture introduced a fundamentally new and homogeneous system structure with the use and development of pointed arches and ribbed vaults. She used a skeleton of graceful girders that carry relatively light vaults wrapped in an orderly arrangement of large, tall spaces flooded with light. The openings were often extremely large and glazed in color (stained glass). Although the orientation of the church with respect to the compass, which became more and more strict in Gothic architecture, seemed to impose a limitation on the appearance of interior lighting. The use of a large number of structural as well as decorative elements helped to soften this strict system of light direction, creating a unique artistic lighting effect for each

building.

During the Renaissance, fine art of a religious orientation appeared at first, to be in sharp contrast with the rational interior lighting and architectural arrangement of buildings. On the one hand, there is an obvious contrast between the mathematically precisely shaped incoming light and the work of fine art. Dealing with his subject and using colors with exceptional impulsiveness, on the other hand, is noticeable in the rational composition of these paintings - a striking sign of the artist's attempt to become independent in the face of the prevailing lighting of the interior of the church. Light, which is often the only applied element that allows relatively easy recognition of almost all forms of Mannerist art, is treated in a calculated and conscious way similar to the Renaissance in architecture, and often serves as the only basis for accurately determining the real dimensions of space among sumptuous spirals and labyrinths of mass and form. . The painting was generally monotonous, unconventional and often shocking, with a bold choice of subjects, compositions and geometric shapes. The light represented Renaissance softness and lightly referred to the characteristics and extremely efficient lighting in the Baroque, which was from one direction and therefore immediately understandable.

In artistic periods before the Baroque Enlightenment, the surrounding holy figures symbolizing God were represented in a way that can be called general and almost dogmatic. The Baroque led to a shift in the representation of fame: each artist illustrated differently, across regions and decades. In addition to the explicit and often colorful Byzantine circles, which are also reminiscent of the architecture of Ravenna, and the equally explicit Renaissance paintings, which already have softer contours and finer tones, three depictions of Baroque origin, almost exclusively typical of that era, became dominant. The usually golden glory of an irregular contour that radiates in all directions is particularly typical for sculptures, it is also present in paintings, and gave the effect of shining rays of the growing radiation of the Sun around the faces of the saints. Glory highlighted by small stars in a special circle, which reminds us of the starry sky of Ravenna, can also be found in sculpture and in painting. Finally, characters without explicit fame were often emphasized only by changing the tone and color of the sky in the background: the long and glowing colors of the Sun's disk were used to draw the eye.

Among countless variations, it is almost exclusively a frequent application of natural forms that will function as a kind of fame that can be said to be general.

The lighting of the classicist church shows - in accordance with the characteristics of that style - the basic features of ancient public buildings. However, since then, the natural lighting design of a single principle cannot be seen to be followed, as the individual has increasingly come to the fore in the field of art; the artist firmly demanded personal attention. The great variety in concepts, structural design and choice of materials no longer allow the statement on analysis of natural lighting to be widely applied. Considering the technical standard of the age, it necessarily brought the moment for the introduction of artificial lighting in sacred interiors, even if it can be said that it happened by chance, and this change resulted in a wide variety of different solutions.

5.3 Overview of selected examples of artificial lighting in synagogues

The Jubilee Synagogue (Czech: Jubilejní synagoga, English: Jubilee Synagogue), also known as the Jerusalem Synagogue (Czech: Jeruzalémská synagoga) due to its location on Jeruzalemska Street, is a synagogue in Prague, Czech Republic. It was built in 1906, and it was designed by the Austrian architect Wilhelm Stiassny (1842-1910) and named in honor of the silver jubilee of Emperor Franz Joseph I (German: Franz Josef Karl, Hungarian: Ferenc József Károly, 1830-1916). The synagogue was designed in the Moorish Revival style with Art Nouveau decoration, especially in the interior. It was recently renovated and still serves religious purposes. Since the independence of Czechoslovakia in 1918, it has been called the Jerusalem Synagogue because the name Jubilee Synagogue refers to the anniversary of the reign of Franz Joseph I in the Austro-Hungarian Monarchy. The synagogue preserves inscribed tablets removed from the former Zigeuner Synagogue, which was demolished during the city's renewal campaign, which was the reason for the construction of the Jubilee Synagogue. The facade and form of the synagogue is a hybrid of Moorish Revival and Art Nouveau, with horseshoe arches on the facade and internal columns supporting the building's women's galleries. The red and white Mudéjar border on the stone facade is particularly striking. Inside, Moorish elements are covered with brilliantly painted art nouveau patterns. After being open to the public as a place of worship for a century, except during the period of Nazi German occupation when it was used to store confiscated Jewish property, on April 1, 2008, the Jubilee Synagogue began to regularly open its doors to tourists and lovers of historical architecture (Fig 9).





<https://thekaplangirlsbigtrip.weebly.com/the-jubilee-synagogue-aka-thejerusalem-shule.html>
<https://stock.adobe.com/sk/search/images?k=prague+synagogue>, Accessed: 8.3.2021.

Fig 9: The Jubilee Synagogue (Czech: Jubilejní synagoga, English: Jubilee Synagogue), also known as the Jerusalem Synagogue (Czech: Jeruzalémská synagoga) because of its location on Jeruzalemska Street, is a synagogue in Prague, Czech Republic, 1906 (architect: Wilhelm Stiassny)

6. Conclusion

In this paper, the phenomenology of light is approached as a physical phenomenon that affects the comfort and practical use of space, and a symbolic phenomenon rich in social and religious meaning. The goal of the author's analysis is basically the formation of a historical and practical basis, on the basis of which it is possible to indicate specific approaches to the use of light design in different civilizational structures and certain periods of their creation. When it comes to the evaluation criteria that were applied in the research/presentation of the complete material, in addition to the conditionality of the moment of creation, they mainly refer to the concept, function, forms, and different approaches within the mentioned forms of sacred objects, i.e., the diversity of spiritual identities is dynamized. This author's approach affirms the interculturality of the language of light, which represents a specific way of creating a place for a contemplative atmosphere of various forms of religious encounters within Judaic temples; light in any religion is a special symbol of the presence of divinity. The phenomenon of light is approached as a physical phenomenon that affects the comfort and practical use of space, as well as a symbolic phenomenon rich in social and religious meaning. In the work, among other things, it is possible to meet covered domes where the structure of the space is symmetrical and centralized, sometimes a lineta (arched window on the roof) is made in the center of the dome. Through the present analysis of sacral objects from different time periods, it is possible to come to the conclusion that daylight in sacral architecture was and is a very important factor that influenced the realization of spatial comfort. Although spatial comfort can have some subjective parameters that determine it, it certainly includes some general parameters, and one of them is certainly daylight, while the intensity of daylight can play a big role in achieving subjective spatial comfort. Therefore, even today, the concept of good architectural practice is certainly not possible or achievable without a functionally designed lighting concept within a spatial unit and strategically designed units to achieve sufficient optimal amounts of daylight. In architecture in general, light is the starting point, it is not just an opening or a window, i.e., a dome, but an element that is thought about at the very beginning so that all the others make sense at the end. This work suggests the

conclusion that the history of architecture is, in fact, a search for light. This is confirmed by the light that dematerializes the surface, becomes more present than the material itself, manipulates the vision and ignites the imagination, depending on the transparency of the material, color, texture, orientation towards the light, quality and quantity of light, the overall arrangement of the space and the position of the observer in it. This paper also suggests the conclusion that light is what enables sacred objects to become architecture, a set of values and their relationships conditioned by the time of creation and spiritual needs/identifications, relationships of existence and consciousness. Light is the anchor that additionally keeps us in the sphere of logical and critical thinking, understanding and reasoning, where not only new or old knowledge is systematized, it gives purpose and enables self-esteem. Light understood in this way is – Credo, manifesto and constitution. It could be said that the motif of light in the sacred architecture of all times is an enigma that needs to be solved again and again.

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