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Understanding Centrality Theories

Socio-spatial Characteristics and Interrelations of City Centers

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ABSTRACT

The study is based on the re-combination or synthesis of international scientific literature, and the definition of the notions *center*, and *sub-center*. A conceptual-structural framework of socio-spatial characteristics of centers (and sub-centers) is set up, these factors are essential elements of making, maintaining, and rehabilitating a city: *Market and Competition; Node and Pole; Faith; Power; Security; Mixture; and Identity*. In an evaluation matrix, the meta-physical characteristics (that are the determining factors of the physical attributes) of these archetypes are drawn. Based on famous theorists, three types of city forms are distinguished: the "*traditional / organic*", the "*modern / planned*", and the "*contemporary / disjointed*" ones. We argue that the historical, theoretical-conceptual background of the triple division is comprehensible. However, this trichotomy lacks some essential elements, "measurable" aspects of city centers – outlined in our study –, which are important in contemporary urban processes and support more realistic urban planning.

KEYWORDS

city center, sub-center, socio-spatial characteristics of city centers, city form, urban planning

1. INTRODUCTION

The first permanent settlers, who later became the first city "designers" and builders, were motivated by socio-cultural and economic reasons. From a historical perspective, the ancient city itself was the center, offering and concentrating necessary socio-spatial functions and forms: being a secure place, for instance a fortification, for a larger territory and community, not neces-

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sarily living in it, but needed for essential socio-cultural, and political-economic activities, later with other communities, in the localized and institutionalized market (place). Cities are complex systems both in a physical-material (tangible) and metaphysical-immaterial (intangible) sense. They concentrate economic and political power, and are the cradle of socio-cultural innovation, breeding new, and creative ideas. Cities and the development of human civilizations are, were, and always will be intertwined. Today, cities host more people (56%) than rural areas,[1] and according to the UN's world population prognosis, will be the home of 66% of the global population by 2050.[2] This fast urbanization means an immense population and territorial growth that – in contrast to traditional cities – requires the constitution of multiple centers in a city. Contemporary trends pose a double challenge to humanity. In terms of *globality,* the bigger the city the more economic it is. This means that economic cities with a compact city structure are necessary, and the *growth* of city population, territory, and distances (both in a physical and metaphysical way) is inevitable. On the other hand, in terms of *locality,* forming smaller communities in global metropolises is a major issue because human nature and communication methods can only handle a limited number of people and require the feeling of *proximity*.

Based on these arguments and challenges, the study attempts to analyze centrality models that are commonly accepted by theorists and are daily used in spatial planning practice. Building the theoretical basis of centers helps planners understand the diversity of centers and the boundaries of policymaking. The aim is to make city structure comparable by the systems of the centers and help policy makers create more sustainable and resilient city structures.

Above all, however, we must answer what the concept of *center* means in a city. The most important research questions of the study are the following: what are the attributes and qualities which make a place a center? What are the most important socio-spatial characteristics, functions, and forms of centers? Are the "spiritual" intangible cultural characters of the center determining factors? What is the relation of center criteria and commonly accepted centrality models? What is the relation of common models and recent network and data science achievements – in other words: what is the relation of centrality theory and practice?

The study is based on the analysis and interpretation of international theoretical literature related to research questions. Please note that the study does *not* attempt to define the notion "city" but accepts what influential urban studies scholars[3] claim: cities are artificial, human-made creatures of civilization having distinctive "urban" qualities and functions. Based on their work, we also argue that *cities cannot exist without a center*.

To back our argumentation, the study uses the following structure: *Chapter 2* introduces common city models (that are centrality models as well) that are widely accepted by scholars and frequently used in planning practice. *Chapter 3* contains the understanding of classical and current scientific literature about the theory of center, laying down and drawing a conceptual framework of the most important socio-spatial criteria of city centers. Finally, in *Chapter 4,* we attempt to analyse common city models compared to the listed criteria of centers, adding other aspects and approaches, including recent achievements of data science and network studies.

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1 The World Bank 2018. Available at: https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS

2 UN WUP 2018.

3 Blumenfeld 1949; Jacobs 1961; Jacobs 1969; Hall 1998; Landry 2012; Lynch 1981; Montgomery 1998.

2. COMMON NARRATIVES OF CENTRALITY MODELS

2.1. Common analogies for cities

Table 1 summarizes influential, widely accepted city models of famous scholars in one chart. Although they use different analogies (theatre, egg, etc.) and different approaches (form, function, ideology, etc.), there are two interrelated common features that can be summarized as a historical trichotomy. The notions *traditional, modern,* and *contemporary* are based on Shane,[4] who uses this trichotomy after drawing a parallel of famous scholars[5] who applied similar analogies (this approach is commonly used in the Hungarian terminology as Meggyesi[6] translated and applied it). To initiate further criticism, it is necessary to briefly explain the historical approach, and understand the ideological and theoretical background beyond.

Table 1. Common analogies for traditional, modern, and contemporary cities

Scholar	**Traditional**	**Modern**	**Contemporary**
Lewis Mumford (The City in History, 1961)[7]	noble (tragic) stage	comic stage	satiric stage
Kevin Lynch (Theory of Good City Form, 1981)	City of Faith	City as Machine	City as Organism
Cedric Price (egg analogy drawing, 2001)	Archi Città (boiled egg)	Cine Città (fried egg)	Tele Città (scrambled egg)
Christian de Portzamparc (2010)	closed	open	transparent in form

Synthetizing theorists, most *traditional* cities can be linked to the preindustrial epoque, while the inauguration of *modern* cities began with the industrialization and motorization; finally, *contemporary* cities are in a strong connection with the so-called postindustrial epoque that began with the information technology revolution. It is a widely held view that traditional cities were created by spontaneous socio-cultural processes over time, while market, power, and faith had a strong connection (which means theocracy in most cases). Modern cities were born with the separation of market, power, and faith (secularization) that needed de-centralization; cities were totally planned and regulated by professionals (engineers) and were developed within a short period. Contemporary cities can be characterized with the pluralism of different ideologies and incrementalism, where the processes are mostly launched and controlled by market.

4 Shane 2011.
5 Lynch 1981; Price 2001; Mumford 1961; Portzamparc 2010.
6 Meggyesi 2009.
7 Mumford (1961) used the original theory of Sebastian Serlio (1537).

2.2. Common features of "traditional", "modern", and "contemporary" cities

To facilitate further discussion, it is necessary to briefly explain the features of common city models. These characteristics were listed by collecting and synthetizing descriptions of famous scholars. Please note that this is a generalized evaluation by its nature, in this way, it contains some vulgarly spread stereotypes. The characteristics of the three archetypes of cities are summarized in *Table 2* and are briefly commented below.

Table 2. A conceptual framework of different characteristics and functions of traditional, modern, and contemporary centers

Cities	Meta-physical characters	Physical characters	Common examples
Traditional	integrity, cohesion sense of place and identity socio-cultural mixture	organic monocentric compact	ancient settlements cities of the antiquity medieval cities
Modern	standardization no distinctiveness (sameness) socio-cultural separation	planned polycentric expanded	"grand design" garden cities housing estates
Contemporary	experimentality affinity to chaos socio-cultural enclaves	disjointed networked spread	mega-cities "new urbanism" enclaves in the city

According to most theorists, ancient, antique, and medieval settlements are *traditional* cities. They are supposed to have a complexity and mixture of various socio-cultural activities where there is an opportunity for exchanging knowledge, information, and cultural experience; the density of activities creates local entrepreneurship, which fosters innovation and provides constant vitality. The cohesion and attachment between the members of the community results in a strong sense of identity, which is considered to be the "heart and soul" of cities. According to influential theorists,[8] they provide the sense of place by having symbolic meaning and protection. The aim of protection manifests itself in a compact city form where symbolic cultural (e.g. theatres), religious (e.g. cathedrals, temples, mosques) as well as politico-economic (e.g. palaces, municipalities, markets) buildings and institutions culminate within a walkable area: *the city as a center.* The organic city network is the result of slow, trial & error building and development. Traditional centers (that are, due to metropolization, now usually absorbed or surrounded by the megastructure of greater cities) often struggle with gentrification, tertiarization, marginalization, degradation, and sometimes abandonment. These threats weaken the sense of place, but traditional cities have a compact urban morphology that provides sustainability.[9]

[8] Blumenfeld 1949; Lynch 1981. 5–16; Nasr 2001. 3–10.
[9] Khoshnaw–Kissfazekas 2018.

Successful rehabilitation examples[10] prove that the mixture of residential, commercial, entertainment, cultural uses, and the consideration of social aspects is necessary.[11]

It is widely thought that *modern cities* evolved as motorization and traffic developments made urban sprawl and the socio-cultural separation of activities possible. This manifests itself in a spatial division of different urban functions, too, which resulted in creating mono-functional patches in the city. The "modernization" of traditional cities was connected to the theory of "sanitation": preventing diseases, crime, and making public spaces more aesthetic.[12] The first modern cities reflect a need of monumentality, or "grand design" as well. Influenced by new socio-political ideas, planners of garden cities (Ebenezer Howard, 1898), neighborhood units (Perry, 1929) and other utopias (like the Plan Voisin of Le Corbusier, 1925) wanted to standardize every aspect of city life, and created universal, conform structures. Many realized modern(ist) architectural environments[13] are frequently criticized because they create uniform, same, non-attractive and "rigid" built environment. Social scientists proved that this resulted in decreased activities, the lack of identity and distinctiveness, and closed communities that are passive, and skeptical about any social, cultural, or economic initiatives and innovations.[14] Urbanists often explain failures of modern(ism) with a missing context, which means that the cultural code of modernism "does not fit neither into the inherited, traditional code system, nor to the visual language of our age".[15] In this way, despite all the progress modernism achieved, the public opinion simply considers the modern city a complete failure and a rupture in architecture history.

In a metaphysical way, *contemporary cities* are the sites of socio-cultural and socio-economic experiments where heterotopias[16] coexist. These urban enclaves concur with each other to evolve new ways of living. Contemporary planners have an affinity to create chaos, and use the methods of collage, carambolage, montage, bricolage, assemblage, and so on.[17] Hierarchic and rigid structures of modernity are now considered outdated and unrealistic. Therefore, they design network structures connecting multiple, thematic areas where (following the utopia of Broadacre City by Frank Lloyd Wright) the spread metropolis is merged with rural areas. Representers of post-modern "new urbanism" create centers and neighbourhoods that imitate traditional cities.[18] Yet we can also see the invention of new ideas, including the theory of Christian de Portzamparc about "open blocks" (îlots ouverts), that unify the advantages of the traditional ("first") town – e.g. the demonstration of street and the urbanity made by density – and the modernist ("second") town – which is composed of solitary objects swimming in the open space – into the so-called "third town" where blocks become transparent, but the boundary between public and private spaces can be clearly identified.[19]

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[10] Including the "Heart of the City" project in Budapest, Le Marais in Paris, or the revitalization of British historic centers like London, Manchester, Bristol, Sheffield, etc.

[11] Grazuleviciute-Vileniske–Urbonas 2011.

[12] Examples: Paris, Vienna, Barcelona.

[13] Including La Défense in Paris, Brasília, and mass housing estates.

[14] Grazuleviciute–Vileniske–Urbonas 2011.

[15] Kissfazekas 2013. 109.

[16] Shane 2011 after Michel Foucault 1986.

[17] Shane 2011. 138–151.

[18] Incl. Getty Center (Richard Meier); Celebration, Orlando; Poundbury (Leon Krier); Vauban, Freiburg.

[19] Portzamparc, 2010. in: Benkő–Fonyódi 2009. 18–19.

2.3. Common city models

These ideological differences manifest themselves on an ideal city form. Based on these theories, especially on the "egg" analogy of Cedric Price,[20] the three models of city / center interrelation can be visualized *(see Fig. 1)*.

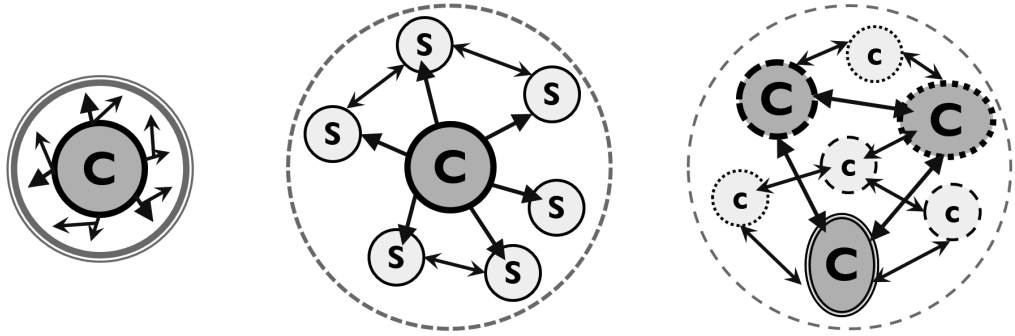

Figure 1. Common centrality models in historical perspective
(Source: Authors' own interpretation and drawing)

In general terms, traditional, "monocentric" cities do not tend to grow beyond the walkable size, which means *the city itself is the center.* They have an exact boundary which reflects the aim of visual integrity, protection, and compactness. It is believed that the separation of activities and the motorization in the modern epoque results in metropolization, and the appearance of sub-centers that have a strong, radial connection to the center. City territories expand, and their boundaries become less exact. Contemporary cities can have more, functionally thematic centers (and sub-centers) that are constantly concurring with each other and have a networked connection. City boundaries disappear, which means that the city–country distinction is not recognizable anymore.

The three different models, often accompanied by ideological motivation, are frequently used in policymaking: planners often use the notions *monocentric, polycentric,* and create different city structure models concerning density, hierarchy, network, and boundary. This means that understanding city models is crucial not only for theorists but also for spatial planners.

3. DEFINITION OF CENTER BY CRITERIA

To answer the question, "what makes the urban/city center", Montgomery[21] claims that first we have to answer what makes a "successful urban place". He lists the three components that foster an urban sense of place: image (cognition, perception, and information), activity, and form.

[20] Price 2001.
[21] Montgomery 1998. 94–96.

Referring to Norberg-Schulz and other scholars like Szentkirályi and Schneller, Meggyesi[22] claims that places can be localized, but they have no exact boundary. He uses the terminology of Hamvas who distinguishes space and place: spaces have exact boundaries, but places have a "face"[23] (which can be explained as identity). Places have only centers and "eradiation", which means that they are intangible and therefore they only have qualitative criteria. Based on the studies and concepts of Montgomery[24] and Meggyesi[25], we list the socio-spatial characteristics constituting three main components (or manifestations) of the centers, which make them urban places *(see Table 1)*.

Table 3. Socio-spatial characteristics, functions, institutions, and forms of urban centers

IDEA & CONCEPT (IMAGE)	**meta-physical (urban activity)**	**physical (urban form, place, building)**
market & competition (socio-economic)	concentration & exchange of goods, knowledge, and information	place ("marketplace") and buildings with retails, restaurants, workplaces, cultural, educational, etc.
node + pole (socio-cultural)	social connections + social capital & networks	place: crossroad, transport hub junction + densification, catch basin
faith (cultural)	sacral life	religious buildings and activity on the place
power (political-economic)	decision-making, governance	governmental & administrative institution buildings and activity on the place
security (geo-political, socio-economic)	citizenship, welfare state, quality life	fortification, exact boundary, all technical equipment & built environment necessary for socio-economically secure urban quality life (energy, water, sanitation etc.)
mixture (socio-cultural)	social diversity	functional diversity
identity (socio-cultural)	character, belonging, legibility, meaning, attractiveness	visual and spatial pattern

As for the first "idea & concept" column, we indicated their thematic field in brackets. We suppose that the listed intangible cultural, "spiritual" factors and functions of the city center have long-lasting effects on cities, providing those socio-cultural characteristics and assets of a city which strengthen their citizens' belonging and identification with their place of living as

[22] Meggyesi 2009.
[23] Hamvas 1989, in Meggyesi 2009.
[24] Montgomery 1998. 95–103.
[25] Meggyesi 2009.

well as "cement" and "glue" the different parts of the city. The main difference between the "traditional", "modern", and "contemporary" city centers is related to the metaphysical, intangible, socio-cultural characters of the center.

3.1. Market & competition

The city is an exchange place, a "market", of tangible and intangible "goods": new ideas, knowledge, goods, and services. They concentrate economic and political power *(see Power)* and breed new, innovative, and creative ideas. Sassen[26] states that the institutional manifestation of the exchange activity is the market. Alexander et al.[27] emphasize that "market of many shops" is an essential environmental pattern of a town. Many scholars[28] claim that the appearance of the permanent settlements and later of cities – and city civilizations all around the world – is a cultural-economic one. The second dietary revolution, or in other terms called "Neolithic revolution", that is, the "discovery" of agriculture itself, the innovation/discovery of domesticated plants and animals in the Fertile Crescent around 8–10 000 B.C., which made the surplus food production possible, accumulation of wealth and transferring it to cultural-religious built, or made, artifacts, which needed a safe place (*see Security*) and could be admired[29] *(see Faith),* and this is how the first villages evolved. As Lynch[30] interpreted the "city building" period millennia ago, villages – the first settled rural communities – with food surplus wanted to have a place for continuous community life as well as a permanent center for their ceremonies *(see Faith),* which can attract other people from around, becoming a pilgrimage center, concentrating and accumulating goods *(see Node & Pole)* by voluntary gifts and tributes at the beginning, myths, ceremonies *(see Faith)* and power *(see Power).* Contrary to these theories, Jacobs[31] claimed that surplus food production was not the catalysator of city inauguration because "cities came first" *(see Faith).* This means city formation, or at least building the holy place and temples, preceded the birth of agriculture.

The need for exchange results in concentration that provides competitiveness. As Landry puts it "the city provides a critical mass. It is an accelerator of opportunities and a generator of problems. It is a laboratory for what is good and bad about living together"[32]. Thus, cities can be understood as mediating socio-cultural innovation hubs, and/or perfect laboratories, quantitatively and qualitatively, large enough for the testing of what is good or bad for communities, being located in-between the macro/national and micro/individual level. Porter[33] emphasizes that sustainable economic base can be created through private, for-profit initiatives and investment based on economic self-interest and genuine competitive advantage. Alexander et al.[34] state that

[26] Sassen 2005.
[27] Alexander et al. 1977. 249.
[28] Incl. V. G. Childe, J. Cauvin, L. Mumford, K. Polányi, K. Lynch, P. Hall, L. Van den Berg, Gy. Enyedi.
[29] Cauvin et al. 2001. 106–109; Lynch 1981. 5–16.
[30] Lynch 1981. 5–16.
[31] Jacobs 1969.
[32] Landry 2012. 126.
[33] Porter 1995.
[34] Alexander et al. 1977. 53.

houses and work should not be separated in space. Sassen and Castells[35] claim that, despite all predictions, the center will not disappear with the development of communication, and cities are and will be the centers of knowledge economy.

3.2. Node & pole

The most important characteristics and functions of the city as offering human made, artificial – built – space and place, for example in the form of various public and semi-public forms, for social interactions, as multiple and complex social interactions and activities, be it economic, political, or cultural, make a city an urban place, provide the quality of urbanity. The concentration of city centers provides meeting possibilities and fosters strong and weak social ties.[36] Alonso[37] proves that there is a correlation between centrality and density, which is indicated by "demand" urban land market. Traffic junctions, water flows, topography and other geographical factors can have attractive (spread) or repulsive (backwash) effect on the form of the "urban corpus".[38] Roncayolo[39] states that city nodes can become a pole, which means that nodes have an attractive effect that accumulates people, services, and functions. This results in an increase of density and compactness of functions *(see Mixture).* Alexander et al. recommend allowing higher density to bulge in from the boundary of the neighborhood, toward the center of gravity of the community (eccentric nucleus[40]); to form density rings; to make nodes of activity (cooperating facilities), promenade; clustered evening establishments; and interchange.

3.3. Faith

Lynch[41] claimed that the first communities needed a center for admiration and worship. From our research perspective, "admire" and "attraction" *(see Node and Pole)* are very important terms, belonging to the intangible dimension and characteristics of urban quality, belonging to the question of identity, image, in Lynch's list being part of the psychological, sensual elements of good cities and forms *(see Identity).* Archaeologist Klaus Schmidt claimed that first came the temple, then the city. This idea is related to Jacobs's theory that cities came first, or at least building the holy place, and temples for worshipping, see the most ancient one in Göbekli Tepe (Anatolia, Turkey). There are some scholars, in particular Jacques Cauvin[42], who claim that the Neolithic, agricultural revolution was more than an economic transformation, it was rather a symbolic, ideological, psychological-cognitive transformation of human communities with its material dimension. In certain places (e.g. Khiam) of the Levantine core of Near East some, probably, god/goddess symbolizing figures preceded the "technical-material" appearance of

35 Sassen 2005; Castells 2005.
36 Granovetter; Polányi.
37 Alonso 1964.
38 Kissfazekas–Gurdon 2014.
39 Roncayolo 1966.
40 Alexander et al. 1977. 155.
41 Lynch 1981. 8.
42 Cauvin 2000; Cauvin et al. 2001. 107–109.

agriculture (domestication of plants and animals). As Nasr[43] explained, the center represents an integrated, synthesized intellectual, intuitive, and spiritual knowledge center *(see Competition),* with a symbolic tangible, cultural-religious building (and/or reliquial element), such as the cathedrals in medieval Europe or the mosques in the Islamic world.

3.4. Power

For millennia, especially before secularization, power has had a strong relation with religion *(see Faith).* The Greek agora of the polis and the Roman basilica were the sites of social life, exchange, worship, and political life. Representative squares are accessorized with monuments that symbolize common values and historical events. Public spaces at central places are the sites of democracy as they provide space for articulating people's power. Alexander et al.[44] stated that "local town halls" are the essential elements of centers that accommodate the self-governance of the community.

3.5. Security

Some of the most important reasons for creating cities were safety and security, in their complex meaning, as cities are equipped with many socio-spatial characteristics, to have a protected, safe, and convenient life, as compared to the ancestors' natural living conditions prone to various environmental and other kinds of threats and hazards for millennia. Mumford considers that the clans and nomads moved to bigger cities as they realized that they have a better chance of survival in larger groups.[45] The security of the citizens in a metaphysical way were provided by special citizen rights (civitas). The tangible manifestation of protection are walls or other kinds of fortification (urbs = walled city in ancient Rome), but it can also be a distinctive (natural or artificial) border. Physical walls of the city were mostly demolished with the territory expansion linked to motorization. But nowadays, with the appearance of enclaves and segregated areas, walls within the city appear again. (Example: gated communities, tech company centers, etc.)

3.6. Mixture

It must be stated in advance that centers are inhabited places, which means that they cannot be abandoned areas or ruins.[46] Mixture manifests itself in a metaphysical way as social diversity (various social groups, ethnicities, life cycle, etc.) and in a physical way as functional diversity (mixed land use and compactness). Alexander et al. emphasize that the "mosaic of subcultures"[47]

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43 Nasr 2001. 3–10.
44 Alexander et al. 1977. 239.
45 Mumford 1961.
46 After Hardoy–Gutman 1991.
47 Alexander et al. 1977. 47.

(neighborhoods) and "household mix"[48] (not one stage in the life cycle is self-sufficient) are essential elements of towns. In the field of sociology, Robert E. Park and Ernest W. Burgess use human ecology to explain the social movements that influence city form.[49]

3.7. Identity

Mumford claims that cities evolved as uncooperative communities realized that they could make their lives collectively easier when they work together for the *common good,* so they gathered around *leaders,* including wise men, healers, and storytellers.[50] In this way, *Identity* is strongly linked to *Competition*, *Power,* and *Security*. Alexander et al. state that environmental patterns (that are the elements of identity) are like "words" of a "language".[51] In his famous work *The Image of the City,* Kevin Lynch distinguishes five categories of environmental elements that form the mental map of people: paths, edges, districts, nodes, and landmarks.[52] He claims that the "image-ability" of the urban form helps the identification of neighborhoods. D. Rypkema has distinguished the main features of the viable and competitive communities, including the sense of place and identity, the sense of evolution, ownership, and community.[53]

4. THE RELATION OF COMMON THEORIES AND PRACTICE

4.1. Discrepancies of center criteria and city models

In *Chapter 2,* we claimed that the relation of city models to historic époques (traditional vs. modern vs. contemporary) is understandable because of the ideological background shaped by history, but we also mentioned that this trichotomy contains simplifications and stereotypes. This means that there are commonly known examples that do not fit in properly. Most importantly, we can name traditional cities where spiritual and/or administrative functions cannot be reached within walking distance,[54] which means that these cities already have a polycentric structure. The existence of planned, orthogonal cities in ancient cultures (incl. Olynthos, Roman castrum, etc.) can also be proved. In this way *(exceptio probat regulam),* we claim that the theories based on a historical trichotomy are not universal. The criteria listed in *Chapter 3* and *Table 3* can have more or less significance in different situations, furthermore, there can be centers where one or several criteria are completely missing.[55] Nevertheless, centers do not evolve if only a few criteria are present because those are only mono-functional patches and not real urban

[48] Alexander et al. 1977. 188.
[49] Robert E. Park and Ernest W. Burgess 1923, in: Shane 2011. 182.
[50] Mumford 1961.
[51] Alexander et al. 1977. XLI–XLIV.
[52] Lynch 1960.
[53] D. Rypkema 1994.
[54] Examples: Karnak, Athens.
[55] Examples: cities of atheist cultures where Faith is missing (new cities of the Soviet Union); centers specialized for innovation and knowledge, incl. tech centers and university campuses (Silicone Valley, MIT).

hubs. Criteria attire one another,[56] and the most exciting about creating centers is to find the "critical mass" of criteria. Every center is "set" by several (geo-political, socio-cultural, etc.) circumstances, which results in an enormous diversity of center configurations. This means that all planned centrality structures are questionable, and theoretic city models have their own inaccuracies that can be specified by new – e.g. big data based – developments in urban sciences.

4.2. Introducing the science of cities

The prospering big data science, aided by network science, expanded the limits of our knowledge. Recently, several research projects attempted to examine urban life, furthermore, made predictions via modelling and simulators.[57] Instead of *"narratives, anecdotes, and intuition"*[58], these provide the *"physics-inspired"*[59] theory of cities. West[60] proves that in the case of material network elements, incl. infrastructure, and services, the exponent of power law is *sublinear,* around 0.85. In this way, bigger city means less pollution per capita. Nevertheless, socioeconomic quantities scale *superlinearly,* with an exponent of 1.15. The bigger the city the more exchange and innovation is possible, but negative tendencies increase as well, including crime, epidemics, etc. These exponents have an inverse nonlinear correlation[61] which, according to West, provides the *"magic of the city"*. The bigger the city the more economic it is,[62] but growth in a closed system (in this case: our planet) is not sustainable,[63] so the superexponential growth of cities will stop. Therefore, we must find *resilient* city models that provide enough *robustness* in case of stagnation, shrinking, and unexpected events.

4.3. The city as an organism

Zahedian and Moossavi[64] claim that history means human–environment interaction over time. This interaction results in a socio-cultural embeddedness which provides the "rigidity" (bond) of the urban fabric.[65] Hardoy and Gutman[66] emphasize the importance of continuity and state that centers are developed on the site where the city was founded. Alexander et al. state that "patterns, which give so much structure to a town or of a neighborhood, cannot be created by centralized authority, or by laws, or by master plans".[67] When it comes to the questions of the differentiation between "traditional", "modern" and "contemporary" city models, many scholars

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56 Examples: other functions move near commercial facilities; institutions move to urban junctions (like intermodal hubs).
57 Including Dirk Helbing's Living Earth Simulator; Bill Hiller's space syntax, and Barabási Lab.
58 Sic! West 2017. 269.
59 West 2017. 269.
60 West 2017. 323.
61 Please note: this scaling is true in the same national-geographic system.
62 Terminology: *the economy of scale*.
63 Meadows–Forrester: The Limits to Growth (1972), in: West 2017. 222.
64 Zahedian–Moossavi 2013.
65 Roncayolo 1966.
66 Hardoy–Gutman 1991.
67 Alexander et al. 1977. 3.

claim that basic differences come from the "consciousness" during planning and development process. Blumenfeld states that in some elements, each city is "planned", it depends on the degree of consciousness, "which elements have been planned beforehand, and which elements have been adapted to unforeseen needs by slow process of trial and error".[68]

Researchers of network studies[69] also claim that organic structures that are the results of slow (step by step) processes are on a higher degree of robustness, and therefore resilient. Aristotle considered the polis an *"organic autonomous entity"*[70]. As Nasr[71] explained, the most important characters of the traditional, sacred cities are that they are like a human body, where the center represents the heart as well as the spirit of the whole body/city, meaning an integrated, synthesized intellectual, intuitive, and spiritual knowledge center, with symbolic tangible, cultural-religious buildings (and or reliquial elements), such as the cathedrals in medieval Europe or the mosques in the Islamic world. However, in a traditional, millennia old spiritual and universal meaning, the center is, or should be, the "heart" of the city, meaning the intellectual and intuitive center of the whole city, from which "everything" starts, and other parts are connected, including the citizens. Metabolism states that cities are ecosystems that evolve, produce, age, and die.[72] Researchers, including A-L. Barabási,[73] state that city structure shows similarities with biological structures, including the human cardiovascular system. West claims that the city is not a top-down engineered machine but rather a kind of organism with fractal-like structure, typical of a *complex evolving adaptive system*.[74] However, planners must not imitate natural forms because orthogonal cities can also have their "lurking" organic structure[75] behind, and common examples of leaf-like, but abandoned garden cities can be named.

4.4. The importance of hierarchy

Sub-centers appear in planning theory with the idea of the "polycentric city" that comes forward at the beginning of the modern epoque when traffic developments and suburbanization result in an urban sprawl of cities, and cities grow beyond a walkable scale. By agglomeration and metropolization, new sub-centers were created parallel with the "old ones" to serve the most important goals and functions of the formal center. To form the "mosaic of subcultures" instead of "heterogenous cities", Alexander et al.[76] claim that decentralization is needed to give local control to communities. He suggests putting the *"magic of the city"*[77] within reach of everyone, with catch basins that do not serve more than 300,000 people. Roncayolo[78] claims that sub-centers are the "democratized" forms of centers, which means that forming sub-centers brings decision-making closer to people. Marchetti (after Zahavi) claims that the "1-hour commute time

68 Blumenfeld 1949. 7.
69 Incl. West 2017; Barabási 2002.
70 West 2017. 247.
71 Nasr 2001. 3–10.
72 West 2017. 247.
73 West 2017; Barabási 2002.
74 West 2017.
75 West 2017.
76 Alexander et al. 1977. 47.
77 Alexander et al. 1977. 61.
78 Roncayolo 1966.

rule" influences city size. Before the industrial revolution, walkable cities ("cities as centers") were needed, that resulted in an approximately 2.5 km radius limit. But motorization facilitated the urban sprawl, and the growth of city size. The peculiar thing is that we still spend an average 1 hour per capita with commuting,[79] and this can be interrelated with habits coming out of human nature. Social scientists[80] also proved that for human beings, the number of interactions, time, and mobility are limited. Contemporary researchers[81] frequently refer to Christaller[82], who outlined the ground-breaking central place theory in 1933 and depicted the *hexagonal lattice concept of central places.* He argued that systems, subsystems, and sub-subsystems are similar, which assumes a hierarchical, *fractal-like* city structure. This theory appeared later by Alain Bertaud[83], who depicts four spatial structures influenced by the pattern of commuting trips, and Michael Batty[84], who highlights the importance of fractal geometry for understanding and planning the physical form of cities. West[85] claims that "understanding global dynamics as a complex evolving adaptive system composed of many interlocking and interacting subsystems that are themselves complex adaptive systems" is crucial.

5. CONCLUSIONS

Analyzing famous scholars' theories and city models, we distinguished three archetypes of centrality forms that are commonly paired with historical époques: the *traditional,* the *modern,* and the *contemporary* ones. We also listed the most important socio-spatial characteristics of centers that are, at the same time, the essential motivators of making a city, and we argued that these conceptual (and ideological) factors – *Market and Competition, Node and Pole, Faith, Power, Security, Mixture, and Identity* – are the determinants of center creation, maintenance, and rehabilitation. Comparing the three archetypes and the center criteria, we claimed that *city models are not universal* and cannot be directly applied in practice. We claim that theoretic city models have their own limitations, but recent – e.g. big data based – achievements in urban sciences allow us to expand the boundaries of our knowledge. The dilemma is still the following: cities provide diversity by the "the more people, the more special needs" law (culture, services, extremities, etc.),[86] but we also need local communities on a smaller scale to make life manageable. This means *diversity is scale-dependent,* and subsystems (sub-centers) evolve naturally, whether planners foster it or not. As a result, all commonly accepted city models are questionable. *Monocentric cities* exist below a certain walkable scale, and due to *agglomeration* and *metropolization,* sub-centers evolve, which makes a city structure *polycentric*. The idea of the *modern city* depicts a centralized city which is a rigid structure and where the center point is

[79] Marchetti 1994.
[80] Incl. Milgram, Dunbar, in: West 2017. 309.
[81] Including West 2017, Shane 2011 and Batty–Longley 1994.
[82] Walter Christaller: *Die zentralen Orte in Süddeutschland* 1933, in: Shane 2011. 24.
[83] Bertaud (2013) classifies the most common urban forms into four categories: the classical monocentric model, the polycentric (or dispersed) model, the composite model, and the "Urban Village" model (that does not exist in real world).
[84] Batty–Longley 1994.
[85] West 2017. 239.
[86] West 2017. 364.

overloaded. The *contemporary* concept of network cities does not exist in real life thus non-hierarchic, dispersed city structures do not provide diversity, and cannot be controlled. We claim that in real life, *an enormous variation of centrality structures exist,* and ideal-typical models can only be applied up to a certain limit; measurements and local characteristics must be considered to design the final structure. We argue that a *hierarchic* approach is still necessary in urban planning and studies, especially in urban policy and governance. However, we also suggest integrating new urban planning methodologies based on *scaling* and *fractal geometry*.

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Városközpont-elmélet

A városközpontok, alközpontok téri és társadalmi jellemzői

ÖSSZEFOGLALÓ

Tanulmányunkban – nemzetközi szakirodalmi kutatás alapján – definiáljuk a *központ* és az *alközpont* fogalmakat. Meghatározzuk a központok (és az alközpontok) téri-társadalmi jellemzőinek konceptuális és strukturális keretrendszerét. Ezek az alkotóelemek – *Piac és Verseny; Csomópont és Pólus; Hit; Hatalom; Biztonság; Vegyesség; Identitás* – a város alapításának, fenntartásának és megújításának feltételei. Egy értékelő mátrix segítségével összegezzük ezen archetípusok metafizikai jellemzőit, és amellett érvelünk, hogy ezek determinálják a központok fizikai tulajdonságait. Elismert szerzőkre hivatkozva ismertetjük a legelfogadottabb városmodellek hármas felosztását: a *hagyományos / organikus,* a *modern / tervezett* és a *kortárs / szétta-golt* tipológiát. Azt állítjuk, hogy a hármas felosztás történelmi, elméleti-konceptuális háttere megalapozott. Ugyanakkor ez a hármasság nem foglalja magában azokat a „mérhető" – a tanulmányban felvázolt – szempontokat, amelyek segítségével a valósághoz jobban közelítő, a tervezési gyakorlatban könnyebben alkalmazható központmodellek vázolhatók fel.

KULCSSZAVAK

központ, alközpont, a városközpontok téri-társadalmi jellemzői, városforma, várostervezés